THE MEDICAL JOURNAL OF AUSTRALIA

VOL. II.—32ND YEAR. SYDNEY, SATURDAY, DECEMBER 29, 1945. No. 26.

Table of Contents.

An Address.[1]

LITERATURE AND THE CLINICAL POINT OF VIEW.[2]

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THE profession of medicine and the profession of letters at first glance seem poles apart. One, the most realistic calling, whose daily concern is with bone and tissue, blood and lymph—and whose pursuit, we have often heard, makes its disciples into hard-headed materialists, convinced that the key to human behaviour lies in the ductless glands or the conditioned reflexes, and sceptical from their anatomy lessons about that imponderable the soul. The other, a highly temperamental, imaginative calling, whose medium consists of those man-made symbols called words, and whose chief aim is the communication of illusion between the artist and his audience. Shall the twain ever meet? Surely the doctor may be forgiven, if sometimes he vents his impatience with the figments of poetry, novel and drama, declaring that real life is more interesting; or if he looks upon the output of the self-tormented, often pathological, literary genius as "laudable" only in the sense that was once applied to certain types of suppuration; or if he retreats altogether from the medium of literary art—the hazy inexact language of common speech—into his specially-designed fortress of medical jargon. This recoil is not new. John Locke, that great philosopher and practitioner of medicine, grumbled two and a half centuries ago that ordinary words were too vague, too inefficient, for purposes of the new learning, and proposed a scientific *lingua franca* for use in these arcane mysteries. On the other hand, let us allow the artist his explosive moments against the physician and other men of science, under his assumption that they have dissected out the heart and soul—in Shelley's phrase, reducing the violet in the crucible, or, as Wordsworth said, exhibiting the curiosity of one

> that would peep and botanize
> Upon his mother's grave.

In a notable American novel, Hawthorne's "The Scarlet Letter", one finds the villain in Roger Chillingworth, the sombre Puritan leech, who has strangled all the humanity in his spirit.

But in the large neutral ground, the no man's land, between these embattled lines, a great deal of fraternizing has steadily gone on, to the profit of both sides. In the enrichment of modern literature, doctors have played a much larger part than other men of science—say the chemist or physicist in his laboratory—and more, I venture to think, than other professionals like lawyers and clergymen. The contacts with human nature of barrister and priest gravitate toward the sinner and the saint—perhaps respectively—rather than to the more typical cross-sections of humanity. Litigation and confession are common enough, within their rigid frames of ceremonial, but illness is still more universal, and its disclosure of human nature, stripped of platitude and posturing, is probably even more revealing.

On the threshold of his career, the physician learns early to master disgust and revulsion through knowledge, pity and charity, and is less quick than others to sit in moral judgement. *Tout comprendre, c'est tout pardonner.* He touches basic human behaviour—its virtue, bravery, self-sacrifice, as well as its vice, cowardice and cruelty—and if he keeps these findings in balance he becomes neither a cynic nor a *naif.* It is given to the practising physician, this man who stands at the doors of life and death, as to few other mortals, to explore the depths of human experience. At his best, he achieves the serenity and

[1] Delivered at the annual meeting of the Royal Australasian College of Physicians on September 28, 1945, at Sydney.

sympathy of the great artist, a Sophocles or Goethe, whether or not he is able to put his feelings into words.

Furthermore, no really good doctor can be a man of illiberal education. Of course your profession has some expert technicians—men who can excise an appendix with neatness and dispatch, graft skin or bone, suture the ends of a severed nerve—but who as well-rounded, sagacious minds are not much superior to the craftsman who makes dentures or fits an artificial leg. An American medical man once said, "off the record": "Doctors may be roughly divided into physicians who know a lot but can't do anything, and surgeons who can do a great deal but don't know much." Obviously this statement is too sweeping, for neither the gifts nor the limitations are so strictly segregated. In general, however, the physician even more than the surgeon must build his career upon a broad base of training that does not end with clinical procedures, but stretches from biology and all that "the science of life" implies—into psychology, sociology, and perhaps philosophy. He says, with Terence, "Nothing human is alien to me". His daily work is a delicate coordination of hand and brain, knowledge and intuition, the physical and immaterial. The ideal doctor, beyond question, must understand what makes human beings "tick", and have in his nature a shrewd streak of the confessor, counsellor and sage. To the lessons of Harvey, Hunter, Lister and Pasteur, he may profitably add those of Shakespeare and Cervantes, Jonathan Swift and Thomas Hardy—classics which, like the great texts in anatomy and pathology, stand for a vast residue of wisdom and also may serve him well at certain vital moments of his practice. Little does he know of medicine that only medicine knows.

May I digress with a word about education? Now that millions of young men are flowing back into civil life, in Britain, America, Australia and elsewhere, with their very human desire to "make up for lost time" and fit themselves in a hurry for professional careers, we shall see a rising demand during the next few years for universities to become purely professional schools, even more than they now are, and for them to lower standards and scrap the so-called "frills" in favour of the narrowly utilitarian. With every sympathy for this natural impatience, and a conviction that it may best be met by technological colleges and trade schools, I venture to hope that the universities will hold the line against it. In equipping young men for certain careers, chemistry and engineering, for example, this trend may not be too vicious, but in others—most of all in your profession, medicine, and in mine, teaching—a great deal of havoc can be wrought by buckling under the storm. Ill-trained, intellectually lop-sided physicians and teachers are capable of heavy damage to our professional standards, and the mass production of such can set us back a generation. The older British universities were long the sheet-anchor of humanism in the English-speaking world; as for our American universities, their widespread requirement of a bachelor's degree in arts, before matriculation in medicine or the granting of a public teacher's certificate, has been one of the most salutary advances of the last thirty years. I am pleased to see that Harvard is now turning away from the too-free elective system she once pioneered, under which there was no single course requirement for graduation, and is now demanding that every candidate for her bachelor's degree take three broad courses—one in world literature from Homer to Tolstoy, another in the social sciences, and a third in the physical and biological sciences. These three, says the Dean of Harvard University, are minimum needs for any intelligent young citizen to get his bearings in the complex world of today. As for medicine, I do not say that every practising physician should write Vergilian hexameters before breakfast, or stow an Iliad in the little black bag alongside his syringe and stethoscope—but that he should have learned, and perhaps forgotten, some of the world's ancient classics, remember a bit of his Shakespeare, and look forward to reading Ibsen and Dostoievsky on a rainy Sunday afternoon. A fine example of our ideal, of humanism in medicine, stems from a name which Canadian, American and British medicine are proud jointly to claim—the late Sir William Osler.

The cross-fertilization between medicine and literature clearly will be greater in direct proportion to the humanistic training of our doctors and the scientific education of our men of letters. English literature has been rich in literary doctors: Sir Thomas Browne with his beautiful cadenced Latinity, Henry Vaughan the poet mystic, Locke and his great "Essay on the Human Understanding", Smollett the satiric novelist, Goldsmith the whimsical essayist and playwright, John Keats the still more splendid genius, and others, whose roll was called some years ago in an illuminating presidential address before the Sydney University Medical Society by Dr. Charles G. McDonald, on "Medical Men and Their Contributions to English Literature". Perhaps the prime reason for this remarkable development is the long, fruitful effect of *litteræ humaniores*, nurtured by Oxford and Cambridge but by no means confined to them, which has dominated British education ever since the revival of Greek in the Renaissance. Browne and Locke, of course, were deep classicists of the Oxford stamp, and Goldsmith was moulded by Trinity College, Dublin, while Keats, the student of Saint Thomas's and Guy's, though lacking this formal regimen, in effect became a poet after looking into Chapman's Homer.

Not all doctors are made into men of letters in the same way. But once a tradition is set, the mutation becomes easier. There was Dr. Bernard Mandeville, for instance, a Dutchman with his Leyden degree, who settled in the London of Queen Anne, and built a lucrative practice among ladies of quality suffering from the vapours; no doubt his clientele helped him become the cynical author of "The Fable of the Bees", arguing that "private vices are public benefits", that civilization feeds upon the follies, luxuries and vanities of mankind; while Tobias Smollett, whose practice lay not in Harley Street but as surgeon's mate in His Majesty's Navy, reached an equally devastating cynicism by a different path. The tradition of the literary physician has continued in Britain up to the present, often with spectacularly successful results. Need we speak of the late Sir Arthur Conan Doyle and Robert Bridges, or of Somerset Maugham, A. J. Cronin, and R. Austin Freeman? It might be remarked that Bridges's last and greatest work, "The Testament of Beauty", sought to reconcile science with traditional faith and humanistic values.

As a newcomer to Australia, and to the interesting literature which your young and vital nation is producing, I have not yet had the chance to read much in the medico-literary field in this country. My meagre acquaintance is confined so far to two books, published and widely read in England—Dr. Charles MacLaurin's "Post Mortem", an application of the Lytton Strachey method to historical diagnosis, which strikes me as entertaining but a shade too speculative, and a better-written autobiography, Dr. H. M. Moran's "Viewless Winds", full of the zest of sport, travel and a busy medical practice, altogether a rather fascinating book. The latter, I was amused to see, pays his disrespects to the former—proving perhaps that there is no undue solidarity in the medical profession, even in Sydney, and no lasting peace between the Celt and the Sassenach. I venture to guess that much fine material in Australian medicine and medical biography lies untouched. Only last week, one of your members told me some episodes from the life story of a South Australian physician, which has all the elements of adventure, suspense and grim humour, of Smollett *cum* Somerset Maugham, calculated to enchant London and Hollywood alike. There is a saying among the book trade in my country that three classes of books are sure-fire best-sellers: books about dogs, about Abraham Lincoln, and about doctors. It seems a pity that this Australian doctor, while he lived, never fell into the hands of a hustling literary agent.

The doctor who turns to literature is not infallibly successful, as one must in conscience admit. In my time, as an amateur and often unwilling critic, I have read some pretty bad prose and even worse poetry, which smelled of the lamp, or the dissecting room. Some works, which I have seen in manuscript, could most charitably be described as masterpieces stillborn, or else examples of that fond

delusion of creativeness termed phantom pregnancy. Now and then, when a doctor turns to literature, he grows lushly sentimental, because he has been so long repressed by the rigours of his profession. In poetry he begins to write in the style of a Swinburne *manqué*, with too many clichés, flowers of rhetoric, lilies and languors. Somewhat out of touch with the current idiom, he is unaware that our newer poets no longer describe a sunset, shall we say, as crimson glory streaming o'er ambrosial isles, but in the manner of T. S. Eliot:

> Let us go then, you and I,
> Where the sunset is spread out against the sky,
> Like a patient etherized upon the table.

Sometimes the tired doctor uses writing as a fugue mechanism of day-dreaming or wish-fulfilment. A few physicians I have known, especially in the South of my own land, where romanticism still lingers in the air, could best be characterized as the walking graveyards of minor poets. And, of course, charlatans are not unknown to both professions. It was a modern doctor, I believe, who recalled that Æsculapius and Circe were half-brother and sister, both children of the Sun by different mothers.

I hasten to add that these ungracious instances are not typical. The average doctor with an itch to write—whether he writes well or crabbedly—is apt to bring to his task the keen realism, shrewd sense, respect for fact and impatience with mere ornament, to which his professional training has conditioned him. He is prone to be too modest, rather than over-confident, about his first ventures into non-professional print. Usually he is a man with something to say—a ripe accumulation of ideas, theories, anecdotes, observations—and like most intelligent people with something to say, cannot help saying it rather well. A man of action, like the explorer and the soldier, he speaks with innate simplicity and directness, without the preciousness of the stylist or æsthete, or the long-windedness of lawyer and politician. Words mean things; thoughts imply acts. Naturally this is the prescription for all good writing: the richest thoughts in the simplest language. The doctor, too, generally has a sense of humour—perhaps a necessary trait of survival in his gruelling and often grim vocation—although the layman often finds that sense of humour either Rabelaisian or else macabre. Instances of the former are best left unillustrated in mixed company. A very mild example of the latter occurs in Dr. Zinsser's autobiography, of which more later. Zinsser tells of meeting an old country doctor one day fishing off the head of Watch Island, and just in the act of hauling out a magnificent pickerel. "What d'ye think, young feller?" he cried, "I caught that fish with a nice fat appendix I took out this mornin'." From Dr. Axel Munthe's "Story of San Michele" you may recall a still better instance in the yarn of the young doctor as corpse-conductor, *der Leichenbegleiter*.

Since the ties between British medicine and literature have already been discussed so ably by your colleague Dr. McDonald and form the subject of a dozen delightful essays by Sir William Osler, I shall speak for the rest of this hour about some personalities that may be a little less familiar to you—drawn from the annals of American medicine.

Benjamin Rush.

According to "The Dictionary of American Biography", the first medical man in the United States "to achieve a general literary reputation" was Dr. Benjamin Rush, of Philadelphia, born in 1745. He went abroad for his medical training, first to the University of Edinburgh, then to Saint Thomas's Hospital in London, where his closest friend was another Philadelphian far from home, Benjamin Franklin. Returning to the New World with this sound equipment, Dr. Rush quickly won recognition among the faculty. In 1772 he published his first little book, "Sermons to Gentlemen upon Temperance and Hygiene", and followed it the next year with a tract against slavery. He was a signer of the Declaration of Independence, and in the American Revolution became surgeon-general of the armies of the Middle Department. A versatile, enterprising man, Dr. Rush had one great weakness, a lack of practical prudence that went hand in hand with an opinionated mind. He embroiled himself in army politics, connived against the military leadership of Washington, and at last found his position so unbearable that he resigned his commission. Back in civil practice, he resumed his career as writer for the public, with tracts on temperance, on education (favouring greater freedom for children, better training for girls), and in opposition to capital punishment. These works were collected in 1798 under the title "Essays, Literary, Moral, and Philosophical"—a far cry from the blandishments which modern book-titles dangle before the reader's eye. Rush meanwhile had taken up with enthusiasm Dr. John Brown's theory that all diseases could be reduced to two types—a simplification which Rush carried to its ultimate conclusion, arguing that all diseases could be tracked to a single cause, a state of morbid excitability or spasm in the blood vessels, which called for bleeding and purging. Phlebotomy was his master passion; he averaged ten ounces of blood per cupping, but avowed that he was willing to remove as much as four-fifths of the blood in the human body. The great yellow fever epidemic of 1793, in Philadelphia, offered him unparalleled scope for these procedures, so that, as William Cobbett drily remarked, Rush's system became "one of the great discoveries . . . which have contributed to the depopulation of the earth". On the credit side, his last important book, "Medical Inquiries and Observations upon the Diseases of the Mind", in 1812, reveals him as a pioneer in psychiatry and even psychoanalysis. His writings for the general public, on schools, slavery and the abuse of alcohol, were in general sound, and his labours helped to make Philadelphia the centre of American medical training up until the founding of the Johns Hopkins Hospital half a century ago.

Oliver Wendell Holmes.

A better doctor and far better *littérateur*, Oliver Wendell Holmes, represents the next generation. Holmes was the son of a prim Boston clergyman, whose orthodoxy helped turn the son—that satirist of Calvinism, "The Wonderful One-Hoss Shay"—toward medicine, just as Holmes's son, the second Oliver, revolted against too much medicine and too much wit, and became one of our greatest jurists. The first Oliver, as a Harvard student, weighed and rejected the profession of letters, writing at the age of nineteen to a friend: "I am totally undecided what to study; it will be law or physick, for I cannot say that I think the trade of authorship quite adapted to this meridian." He had a go at law, but found Blackstone and Kent soporific. His predestined bent was elsewhere. Perhaps one may find early symptoms of the clinical point of view, even of what I have called the macabre, in an incident that had happened when Oliver was not yet eight years old. He had taken his younger brother, aged five, to witness the last public hanging in Cambridge, on Gallows Lot—and was soundly rebuked at home. Now, on the threshold of his twenties, Holmes fell under the spell of Dr. James Jackson. He decided to read medicine—a profession whose object was Man, not artifice, and remained all his life extremely allergic to lawyers. (When his first-born, many years later, broke the news of his impending decision, the father looked up in amazement: "What's the use of that, Wendell? A lawyer can't be a great man." Of course, in refutation of Dr. Holmes, any American can point to Thomas Jefferson, Abraham Lincoln and Franklin Roosevelt.)

The young candidate for medicine found the lecture rooms and dissecting laboratories much to his taste, but had to master an aversion to the operating theatre—after his first glimpse of Dr. Bigelow, saw in hand, his old black suit stained with blood, bending over a man half drunk with whisky, who screamed while the medical students held him on the table. Holmes never liked surgery, and in later years would ask his assistant to kill a rabbit for dissection while the doctor left the room, and please to keep it from squeaking.

To a school friend, in March, 1831, young Holmes wrote the following "startling" announcement:

> I have been a medical student for more than six months, and am sitting with Wistar's Anatomy beneath my quiescent arm, with a stethoscope on my desk, and the blood-stained implements of my ungracious profession around me. I do not know what you will say, but I cannot help it. . . . It is a sin for a puny little fellow like me to mutilate one of your six-foot men as if he was a sheep—but *vive la science*!

Holmes here alludes to his physical insignificance, which he never forgot—what he once called his "five feet five (not four, as some have pretended)". And to the same friend he reveals his dormant literary passion:

> I must write a piece and call it records of the dissecting room, so let me save all my pretty things, as plums for my pudding. If you would die fagged to death like a crow . . . be a schoolmaster; if you would wax thin and savage, like a half-fed spider, be a lawyer; if you would go off like an opium-eater, in love with your starving delusions, be a doctor.

The new capital of world medicine was no longer London, but Paris, and thither young Holmes sailed in 1833, to study under surgeons like Baron Dupuytren and Lisfranc (who remembered Napoleon's guardsmen because "they had such magnificent thighs to amputate"), and above all the great Louis. Holmes acquired one of Chevalier's microscopes to bring home, along with four human skulls and two complete skeletons (the big one, "the showier one", for his brother-in-law Dr. Parsons). On the voyage west he summarized the lessons he had learned:

> Not to take authority when I can have facts; not to guess when I can know; not to think a man must take physic because he is sick.

Harvard gave him a doctor's degree, and he won a prize with his research paper on intermittent fever. At this same Commencement he recited from memory a Phi Beta Kappa poem he had composed, which ran for one hour and ten minutes—and standing on a chair he sang a solo at the alumni dinner. Without the solid ballast of medicine, he might have seemed a rather frivolous young man. But already he had taken versatility as his talisman, writing in 1832:

> The knowledge of a man who confines himself to one object, bears the same relation to that of the liberal scholar, that the red or violet ray of a prism does to the blended light of a sunbeam.

Now he hung out his doctor's sign, with the remark that the smallest favours, or fevers, would be gratefully received. Another prize he won with papers on "Neuralgia" and "Direct Exploration in Medical Practice", and planned a medical school of his own, where clinical observation rather than the study of classical authors would be the guiding star. In 1843, his paper on "The Contagiousness of Puerperal Fevers" was inspired by observation that certain doctors lost in child-birth a sequence of perhaps half a dozen patients at a time—because, Holmes conjectured, their instruments were wiped again and again with the same towel, their gloves or clothing not changed. His belief that child-bed fevers were contagious, and spread chiefly by obstetricians and midwives, roused a storm of denial from certain colleagues, and abuse for this young heretic. Holmes's reply was one of the finest things he ever wrote. You may recall a paragraph beginning:

> I am too much in earnest for either humility or vanity, but I do entreat those who hold the keys of life and death to listen to me also for this once. I ask no personal favour; but I beg to be heard on behalf of those women whose lives are at stake, until some stronger voice shall plead for them.

An Aberdeen doctor had been the first to advance this theory, back in 1795, and of course after Holmes's paper came the work of Semmelweis, which so brilliantly vindicated it. But Holmes's sturdy championship of it, and his giving the name of "anæsthesia" to a Boston dentist's method of alleviating pain, are his twin claims to medical immortality.

In his most characteristic moods, this fluent talker, great diner-out and indefatigable writer of poems and odes for banquets and anniversaries, this autocrat of his own breakfast table, married to a wife who contrived loyally to laugh over a lifetime of Dr. Holmes's puns, was symptomatic of his day—the season which a modern critic has called the Flowering of New England. A new playfulness, a literary levity, was rising in the cold east wind of once-Puritan Boston, and even the new dignity which came to Dr. Holmes in 1847, as Dean of the Harvard Medical School, did not congeal his boyishness. Soon another Harvard dean would take as his motto "*Dulce et decorum est desipere in loco*". Holmes's gaity, fun and nonsense were irrepressible. His old mentor Dr. Jackson had gravely compiled a book of "Advice to the Young Physician", starred with such counsel as: "Enter the sick room with grave demeanour. Then your patient will know you feel for him. But leave with a cheerful countenance, so the sick man will think his case is not too serious." So Holmes tried his hand at advice, but it turned humorous in his fingers:

> If the poor victim needs must be percussed,
> Don't make an anvil of his aching bust;
> (Doctors exist within a hundred miles
> Who thump a thorax as they'd hammer piles;)
> So of your questions, don't in mercy try
> To pump your patient absolutely dry;
> He's not a mollusk squirming on a dish,
> You're not Agassiz, and he's not a fish.

But patients, particularly the richer ones, the *malades imaginaires*, distrusted a physician with too sharp a sense of the ridiculous, and for a while Dr. Holmes's practice swung toward the indigent poor in the wards on Fruit Street.

His medical students at Harvard, however, who called him Uncle Oliver, were far more appreciative. Although he lectured at one o'clock—the worst spot of the day, after four solid hours of *materia medica*, chemistry, practice and obstetrics—his classes in anatomy were the largest and jolliest in the medical school, and students fought for front seats, even though the cadaver on the board before them lacked the benefit of refrigeration. He hated jargon. "We don't *ligate* arteries", he said, "we *tie* them." It was Dr. Holmes who once alluded to the pubic arch, "under which every candidate for immortality must pass". Perhaps, in the haste of the moment, he had forgotten Julius Caesar and Macduff. Or, taking a posterior view, he would remark: "These, gentlemen, are the tuberosities of the ischia, on which man was designed to sit and survey the works of creation." Or, alluding to the shrinking of facial tissue in the aged, especially when the dental structure is impaired: "No doubt you have noticed the extraordinary way in which elderly people will suddenly shut up their faces like an accordion." This is recognizably the author of "The Autocrat of the Breakfast Table"—likening controversy to the hydrostatic paradox, because it equalizes fools and wise men, or comparing the pupil of the eye to the mind of a bigot: the more light you pour on it, the more it contracts. In his medical lectures, these vivid similes had a real mnemonic value. What student could forget, for example, that the mesentery reminded Dr. Holmes of his grandfather's shirt ruffles? Or that the tiny coiled tube of a sweat gland looked like an elf's intestine?

Catherine Drinker Bowen, in her fine biography of Holmes's son "Yankee from Olympus", to which I am indebted for many of these quotations, states that both the Doctor and his students were always pleased when he said something good, and that the Doctor often repeated it *en famille* at the evening tea-table. At times one suspects that long living beside such a fount of *bons mots* and intolerable cleverness told upon the junior Holmeses. Life with Father made them serious beyond their years. Certainly the good Doctor—who once declined to serve on a university committee, saying with a courage some of us envy that he could not, because he suffered from being bored—was but dimly aware of his own shortcomings. Generously padded with the integuments of vanity, he once observed: "I was always patient with those who thought well of me, and accepted all their tributes with something

more than resignation." Yet he once wrote an essay about those insufferably vivacious people who make the meeting-up with a dull friend a most welcome relief: "It is like taking the cat in your lap after holding a squirrel."

The keenest trace of medicine upon his writings appears in those three works of fiction which he called "my medicated novels"—"Elsie Venner", "The Guardian Angel", and "A Mortal Antipathy", all concerning phobias and inherited tendencies. The best of them is "Elsie Venner", about a girl born after her mother had been bitten by a snake, who therefore develops certain congenital serpentine traits, and as you may suppose, is a rather unpleasant young lady to meet, in a garden or anywhere else. While writing the book, Holmes obtained a large and lively garter snake which he kept in a cage at the medical school, and also hung up a stuffed rattler in his library. "Father is nothing if not thorough", said young Wendell sombrely to his uncle John.

Despite minor shortcomings and absurdities, Dr. Holmes was a very distinguished man with a vigorous mind, crystal-clear rather than subtle—a lover of logic and order, in effect an Augustan trained by nineteenth century science, who once wrote: "New ideas act upon society as oxygen does upon the body, attacking its errors, which pass away from the lists of human beliefs, and strengthening the new truth which is building in its place." With his notable services to medicine, literature and education, he well deserved the rare honour of receiving the honorary doctorate of both Oxford and Cambridge in the same year, 1886, shortly before his death. Thinking of that long, versatile career, a gushing lady caller a few months before his decease blurted out: "How superb your death notices will be!" The doctor, who obviously would have enjoyed reading those notices, started from his fireside reverie. Then he told her a little story. "Have you heard of Madame and her husband in the Siege of Paris?" he asked gravely. "Everyone was starving. Madame had a pet lapdog: shall we call him Fido? Finally, in desperation, she had him cooked and served, nicely garnished. Madame and her husband picked the platter clean, wiped up the gravy with their fingers for lack of bread. Madame looked at the remains and sighed. 'How Fido would have enjoyed those bones!'" The visitor gasped, and took her hurried departure, leaving Dr. Holmes to his fireside reverie.

Silas Weir Mitchell

In 1856 Dr. Holmes had advised a young Philadelphia physician, Silas Weir Mitchell, not to publish a collection of poems which he was about to offer shyly to the printer. Almost thirty years went by before Dr. Weir Mitchell printed his first book of verse, "The Hill of Stones". In the meantime he had done brilliant research on the crystallography of hæmoglobin and on toxicology (particularly the venom of rattlesnakes), and as a Union surgeon in the Civil War had studied nerve wounds and battle shock, and greatly advanced knowledge of the peripheral nerves. His treatment for nervous disorders—rest, over-feeding, massage, electrotherapy—as elucidated in his book, "Fat and Blood", became something of a classic; and his description of the rare disease, erythromelalgia, was so adequate that it has since been known as "Weir Mitchell's disease". Throughout a busy life of research, teaching and clinical practice in Philadelphia, Dr. Mitchell miraculously found time to write—popular books like "Wear and Tear", urging his countrymen to take more exercise, and a host of historical novels, of which "Hugh Wynne, Free Quaker" and "The Red City", about Philadelphia in the yellow fever epidemic, are best. He also wrote some keen fictional studies about abnormal women—dominant souls, adventuresses and schizophrenics—out of his rich clinical knowledge. Generous with money, liberal and tolerant, one of the great hosts who presided over "the best talk in Philadelphia", Weir Mitchell seems to have been a singularly attractive character.

Other Medical Men of Letters.

A thorough student of medicine and literature in America might speak, as I lack time to do, about those doctors who longed to be humanists and men of letters, but never somehow found the opportunity—like William Henry Welch, "Popsy", who as a youth aspired to teach Greek at Yale, but was unable to convince the university of its need for him. He therefore began half-heartedly to follow his father's footsteps into medicine, slowly caught the ardour of his profession, and at last became one of the greatest teachers of medicine that Johns Hopkins and the United States have ever had. Beyond a rare talent for letter-writing, Dr. Welch's gifts for literature never fructified. Or one might speak of occasions where literature led directly into medicine. Will and Charlie, sons of old Dr. Mayo in Minnesota, growing up after the Civil War, revelled in the "Leatherstocking Tales" of James Fenimore Cooper, along with their parents' stories of Indians on the plains; so the boys developed a special interest in the bones of Cut Nose, the wild Sioux, which the doctor kept in a big iron kettle in his office, and there they learned their first lessons in osteology. Accidents, to be sure, but not unimportant ones, in the annals of American surgery.

Often a doctor never writes the book of which he dreams for the simple lack of time. The long uninterrupted working day which most writers find the *sine qua non* for literary labour, unharassed by worry, not invaded by the importunate clamour of telephones or the tyranny of the clock—this is the never-never land of a practising physician. Our greatest laryngologist, Dr. Chevalier Jackson, longed for years to write a book, medical to be sure rather than literary, but probably would never have done so had not an onset of tuberculosis, at the age of forty-eight, given him the luxury of a year in bed, where he wrote his "Peroral Endoscopy and Laryngeal Surgery". Sometimes a physician enjoys an Indian summer of brisk literary harvest, then retreats again into silence. Dr. Joseph Collins, a New York neurologist, after many years of practice and an austere volume on pathology, took a year's vacation in Italy and came home to launch a series: "The Doctor Looks at Literature" (1923), "The Doctor Looks at Biography" (1925), "The Doctor Looks at Love and Life" (1926), "The Doctor Looks at Doctors" (1927), "The Doctor Looks at Marriage and Medicine" (1928), and "The Doctor Looks at Life and Death" (1931). Having apparently exhausted the horizon of his observation, Dr. Collins has published nothing for the past fourteen years. The fashion for medical autobiographies in America began about ten years ago with Harvey Cushing's memoirs of brain surgery in the First World War, "From a Surgeon's Journal", and continued with best-sellers like Victor Heiser's "An American Doctor's Odyssey" and Arthur Hertzler's "The Horse and Buggy Doctor". Some of Heiser's colleagues, in plague control work in the Far East, have not yet forgiven him for appropriating some of their best stories without credit; one of them suggested a subtitle for the volume, "Alone in the Orient". As of today some irony attaches to Heiser's chapter on the Japanese, titled "A Great Little People", praising them as "the only Orientals who have been able to rise above their own self-satisfaction, and have, furthermore, disturbed the mass inertia of other Orientals with whom they have come in contact". But the only really sinister book, in the light of future events, to come from a doctor's pen in America was "Man the Unknown", in 1935, by the late French surgeon and research fellow of the Rockefeller Institute, Alexis Carrel. In terms of his later enthusiastic collaboration with the Nazis, one may now read his proposals for a High Council, the intellectually élite, to rule the whole world for its own good, and set right the heresies of democracy, denying to stupid people not only the right to vote but all legal rights whatsoever. Dr. Carrel and Charles Lindbergh, it will be recalled, invented the device which came to be known as "the mechanical heart"—in itself not a bad symbol of their Fascist predilections.

Our best popularizer of medical facts in America is Paul de Kruif, a competent bacteriologist, also from the Rockefeller Institute, who in 1925 supplied the technical background for Sinclair Lewis's "Arrowsmith"—one of those hero-worshipping books about physicians, the men in white, the miracle-workers, which laymen adore but which tend slightly to embarrass and annoy the average modest doctor,

who knows all too well the limitations of his art. After volumes like "Microbe Hunters" and "Hunger Fighters", De Kruif's latest is called "The Male Hormone", published a few weeks ago.

A word about two of our poet physicians, names which the majority of Americans have not heard, but are familiar to esoteric literary circles. William Carlos Williams, a New Jersey pædiatrician of English, Dutch, Spanish, Basque and Jewish descent, is author of a dozen volumes of prose and poetry which are considered by the vanguard as quite the last word in advanced modernity. I have only time to read a single poem, which he selected some years ago as his own favourite among his works. "In fact, I find the poem quite perfect", he wrote with engaging simplicity. It is called "The Red Wheelbarrow":

> So much depends
> upon
> a red wheel
> barrow
> glazed with rain
> water
> beside the white
> chickens.

Perhaps the tastes in poetry of a pædiatrician are highly sophisticated; frankly I cannot confess much pleasure from reading William Carlos Williams, except for a book of prose called "In the American Grain".

Merrill Moore, a young Tennessee neurologist and psychiatrist, now overseas with the medical corps but normally in practice in Boston, holds probably an all-time quantitative record. He spawns sonnets with the fecundity of a salmon, writing them in shorthand, in taxi-cabs between office and hospital. At the age of thirty-seven he had written approximately 50,000 sonnets. A book containing one thousand of them, appropriately called "M", published in 1938, mirrored the fantasies, neuroses, psychological nuances, and case histories which seem unfailingly to supply him with the raw material of poetry. The dominant theme of death may be illustrated by "Unknown Man in the Morgue":

> Tortured body, lie at rest alone
> Finally on the long and merciless
> Slab of now cool lava-molten stone,
> And wait our mutual and final guess
> At your identity, nameless, homeless one.
> No suburb avenue, no numbered house
> We know for you; no date of birth nor death
> Are yours, though somewhere visitors may carouse
> In a forgotten room where once you lived,
> Fathered, soned and brothered, lovered, wived.
> But here you come unfollowed to this place,
> With an anonymous grimace on your face
> In death, whose last name and whose last address
> Will now be yours in your last loneliness.

Hans Zinsser

Another sonneteer, the late Dr. Hans Zinsser, a great bacteriologist and immunologist, in his autobiography "As I Remember Him", written in the third person, describes how he always composed in a state of mild intoxication.

> A sonnet usually cost him a quart of Scotch, and, since he favoured the Shakesperean form, he never got the last two lines on the first quart. After he had worked himself to the second and third quatrain, he usually miscalculated, was too fuddled for the perfect ending, and put it off until the following evening.

Prose, adds Dr. Zinsser, he always wrote stark sober, except that when he essayed educational subjects, "a spot of beer put him into the solemn-ass mood and thus a little closer to the state of mind of the professional pedagogue". Zinsser's parents had left Germany in the mid-nineteenth century, seeking an asylum of freedom, and for the later Reich of Kaiser Wilhelm and Adolf Hitler their son felt nothing but revulsion. As a young doctor, walking the wards of a New York hospital, or riding the ambulance into the worst tenement districts, and a little later working to stem the Serbian typhus epidemic of 1915, Zinsser discovered that nothing could ever take the place of clinical experience.

> It came upon me suddenly that I was profoundly happy in my profession, in which I would never aspire to administrative power or prominence so long as I could remain close, heart and hands, to the problems of disease.

From Mexico to North Africa to China he studied *in situ* the worst pestilences to which flesh is heir—leprosy, cholera and typhus in particular—and set down his reflections for the layman in "Rats, Lice and History", published in 1937, the year after he succeeded in isolating the typhus germ. Here he was more at ease than among the Park Avenue patients, whose ills he had never learned to handle in accord with the advice of a veteran counsellor, who told him: "All patients, especially women, expect the doctor to act as though they were really sick—but bearing up bravely. . . . Pat the hand and say, 'Brave little woman'. . . . Act thoughtful; and if you don't know what to say, say nothing, but say nothing deliberately and slowly." At the age of sixty, after a distinguished career in the Harvard medical school, Dr. Zinsser knew that he was dying of leuchæmia, with little more than a year to live. Fortunately, before that year was spent, he was able to announce a long-sought method of producing typhus vaccine in mass quantities—just in time for World War II. Then he sat down to write his autobiography, a book as tender and serene, though not so deep or wise, as the last dialogue of Socrates, with eternity looking over his shoulder. Zinsser wrote of himself:

> As the disease caught up with him, he felt increasingly grateful for the fact that death was coming to him with due warning and gradually. So many times in his active life he had been near sudden death by accident, violence, or acute disease; and always he had thought that rapid and unexpected extinction would be most merciful. But now he was thankful that he had time to compose his spirit and to spend a last year in affectionate and actually merry association with those dear to him.

In September, 1940, the prognosis was fulfilled.

Conclusion.

This hasty review of letters and the profession of medicine has at least lent fresh confirmation to the old maxim that style—or better still, literature—is the man himself. The doctor's contribution to letters has been legion, and not in any sense a type or stereotype. He has written novels, stories, poems, plays, biographies, essays, memoirs. Often his professional interests condition the imaginative literature he writes, as when the neurologist or psychiatrist turns to the psychological novel or poem, and the general practitioner to the anatomy of wider human nature. But whatever he attempts, any doctor worth his salt leaves upon the page the stamp of his sympathetic curiosity, the hallmark of his convictions about the comedy and tragedy of man's life on this planet, and the integrity of a profession whose twin aims are the search for truth and the alleviation of suffering.

A REPORT ON THE TRANSFUSION OF 2,386 LITRES OF BLOOD.

By R. J. WALSH,
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DURING a period of eight months 2,386 litres of blood were supplied by the New South Wales Red Cross Blood Transfusion Service to civilian medical practitioners and public hospitals in the Sydney metropolitan area. Each bottle so supplied was accompanied by a label, reproduced below, and the medical officer who administered the blood was requested to return the label after completion of all the details. A high percentage of these labels have been received. An analysis of the details is of some interest because of its bearing on the future organization of blood banks and donor services.

The New South Wales Blood Transfusion Service was organized primarily to meet the requirements of the armed services. The organization of the civilian service was undertaken when it was realized that hospitals and private practitioners could be assisted in blood transfusion work by the establishment of a central reserve of blood. Group O blood alone has been supplied to the army units so as to avoid wastage of blood and to eliminate the risk of incompatible transfusion reactions. Such reactions might occur if the group marked on the soldier's identification disk was used as the guide to the choice of blood, when, as is sometimes inevitable, the cross-match test has to be omitted.

TO BE RETURNED TO THE RED CROSS BLOOD TRANSFUSION SERVICE.

Name of patient.....

Blood group.....

Hospital.....

Diagnosis.....

Amount of blood used.....

Beneficial results Yes / No .....

Any reaction.....

Date .....

Signed .....

This report does not concern the use of group O blood supplied to army units. It can be stated, however, that the use of group O blood for all patients has been successful, that the transport of blood in ice-boxes by aeroplane has been satisfactory, and that reactions have been infrequent. Only one case has been reported in which the use of "universal donor" blood may have been responsible for a non-fatal hæmolytic reaction.

When blood was first supplied to civilian hospitals an attempt was made to persuade hospitals and medical practitioners to use group O blood in all emergency cases. To avoid wastage, only group O and group A blood is held in reserve. Group B and group AB blood is collected at the convenience of the transfusion service when such blood is specially requested.

Details of the collection of blood are not included in this report. Every care is taken to avoid pyrogenic substances in the preparation of flasks, solutions and collecting apparatus. The small number of pyrexial reactions from the administration of serum is proof of the success of these measures. A strict aseptic ritual is observed in the collection of blood. No instance of an infected intact flask has been reported, and no cases of septicæmia have occurred either in the army or in civilian recipients. Further, blood from over 300 flasks has been submitted to cultural examination with negative results.

The difficulty of obtaining more details than were provided for on the label makes a classification of the severity of reactions and the conditions for which the blood was used somewhat unsatisfactory. Further, it has at times been impossible to decide whether a rise of temperature was the result of the transfusion of blood or whether it was due to an intercurrent infection or to the factors causing a post-operative rise of temperature. Because of this difficulty, all increases in temperature have been included as transfusion reactions. Hospitals and medical practitioners have been requested to inform the transfusion service of all severe reactions. The majority of these reactions have been investigated and details are given.

Results.

Conditions for which Blood has been Administered.

The number of litres of blood used in the various conditions is shown in the appendix.

It will be seen that hæmorrhage has been the principal indication, and that hæmatemesis has been the most common manifestation of hæmorrhage. In view of the controversy that centres on whether or not patients with hæmatemesis should receive transfusions, Table I is of interest.

TABLE I.

Number of Patients with Hæmatemesis.	Amount of Blood Received by Each.
111	1 litre.
26	2 litres.
9	3 litres.
2	4 litres.
3	5 litres.
1	9 litres.
1	10 litres.
1	11 litres.

A further point of interest is the relative frequency of transfusions in obstetric practice; 214 litres were used *post partum* and 189 litres after abortion; 38 litres were used in the treatment of ruptured ectopic gestations.

In all, 460 litres were used in the treatment of anæmias and other blood dyscrasias; 65 litres were administered to patients suffering from pernicious anæmia—an amount which appears large for a condition known to respond to medication. Sixty-seven litres were used in the treatment of aplastic anæmia in 13 patients; two of these patients received 11 litres, another 10, and a fourth 6. Sixty-eight litres were administered in the treatment of leuchæmia of various types in 26 patients—an average of about 2·5 litres per patient.

The amounts used for thoracic and urological surgery are of interest. It is probable that a number of cases of hæmorrhage were due to operation, but because sufficient details were not available, they could not be definitely placed in this class. Figures from the Mayo Clinic indicate that in that institution the amount of blood used for pre-operative and post-operative treatment was greater than that used for other purposes. Whilst transfusions are probably used less frequently for this purpose in Australia, it is certain that the pre-operative and post-operative use of serum has considerably reduced the number of transfusions of blood.

The amount of blood administered to patients suffering from infections of various kinds was higher than was expected. It is probable that secondary anæmia rather than the infection itself was the indication for transfusion in the majority of instances, and that transfusion to supply immune bodies was less commonly given than transfusion to supply red blood cells. It is possible, too, that some transfusions were given to assist in combating the peripheral circulatory failure of acute infection.

Finally, it can be seen that 239 litres of blood were administered to patients suffering from carcinoma. Again, it is probable that surgical treatment was undertaken in a large number of these cases. Carcinoma of the stomach and colon was the most common indication.

Amount of Blood of the Various Groups Supplied.

Table II shows the amount of blood of the various groups that has been supplied. The percentage of the various groups is compared with that found in the general population.

TABLE II.

Blood Group.	Amount of Blood Supplied.	Percentage of Total Amount of Blood Supplied.	Percentage of Each Group in the Population.
Group O	1,829 litres.	76·5	48·9
Group A	492 litres.	20·7	38·4
Group B	48 litres.	2·1	9·7
Group AB	17 litres.	0·7	3·0

It is obvious, therefore, that group O blood was used for a large number of patients whose blood belonged to groups other than group O.

The Use of Blood of Various Groups.

Table III shows how the blood supplied was used for patients of various blood groups. It also shows the incidence of reactions in relation to the blood groups.

TABLE III.

Blood Administered.	Total Number of Transfusions.	Percentage of Total.	Number of Reactions.	Percentage of Reactions.
Group O to Group O	1,278	53·2	119	9·3
Group O to Group A	225	9·5	29	12·9
Group O to Group B	101	4·3	3	3·0
Group O to Group AB	30	1·3	1	3·3
Group O to Unknown	195	8·2	13	6·7
Group A to Group A	491	20·6	46	9·4
Group B to Group B	48	2·1	8	16·7
Group AB to Group AB	17	0·7	1	5·9
Group A to Group AB	1	0·04	0	0

The percentage of reactions when group O blood was administered to patients with group A blood (12·9) is higher than that when group O blood was administered to patients with group O blood or when group A blood was administered to patients with group A blood; but the difference is not statistically significant. This is seen also from Table IV, which is drawn up from the figures in Table III.

TABLE IV.

Type of Blood.	Total Number of Transfusions.	Percentage of Total	Number of Reactions.	Percentage of Reactions.
Blood of same group as patient's blood ..	1,834	77·0	174	9·5
Blood of Group O, to patients known to belong to other blood groups	356	14·9	33	9·3
Blood of Group O, to patients of unknown blood groups	195	8·2	13	6·7

The low incidence of reactions when group O blood is administered to patients without preliminary determination of the blood group is probably explained by the fact that the majority of these transfusions were urgent, and it is well known that reactions are fewer when the patient is in a state of peripheral circulatory failure than when the blood volume is normal.

A further analysis of the figures in Table II shows that of the recipients of blood group A, 225, or 31·5%, received group O blood; of the recipients of blood group B, 101, or 67·6%, received group O blood; and that 30, or 64%, of the patients of blood group AB received group O blood.

Nature of Reactions.

Table V indicates the nature of the reactions reported and attempts to correlate the nature of the reaction with the indication for the use of the blood. The figures are given in detail because of their bearing on many controversial points, some of which will now be discussed.

Frequency of Reactions in Various Conditions.—It is commonly stated that patients suffering from certain conditions, such as leuchæmia and carcinoma, are especially liable to transfusion reactions. From Table V it will be seen that in these two particular conditions the reaction rate was less than the average—and this in spite of the fact that repeated transfusions were commonly given, especially, as before mentioned, in leuchæmia. The highest incidence of reactions was seen in patients suffering from hæmophilia and purpura, agranulocytosis and septic miscarriage. The numbers are, however, very small in the first two of the three conditions, and a high incidence might reasonably have been expected in the case of septic miscarriage. It is surprising that the reported incidence of reactions was not higher in septicæmia and "other infections", because it is difficult to distinguish a rise of temperature due to the infection from one due to the transfusion. The incidence of reactions in patients suffering from pernicious anæmia was significantly higher than the average. The only explanation that can be

TABLE V.

Type of Reaction.	Post-Partum Hæmorrhage.	Ante-Partum Hæmorrhage.	Incomplete Miscarriage.	Septic Miscarriage.	Ectopic Gestation.	Hæmatemesis.	Other forms of Hæmorrhage.	Pernicious Anæmia.	Aplastic Anæmia.	Other Anæmias.	Leuchæmia.	Hæmophilia and Purpura.	Pre-Operative and Post-Operative Care.	Septicæmia.	Other Infections.	Carcinoma.	Agranulocytosis.
Reactions classified as slight ..			3	5	1	1	1	1	1	1			1		1	1	1
Temperature rise			4		1	10	5	3	1	4	2		4	2	7	3	1
Rigors	6	1	5	5		8	10	3	2	11	2	1[1]	13	1	10	12[1]	2
Urticaria	2				1		3	2		1		2	2		3	3	
Anaphylactic reaction ..								1[2]								1	
Pulmonary overloading ..									1	1					2[4]		
Jaundice								1[3]			1[1]		1[1]		1[4]		
Hæmoglobinuria													1				
Unspecified reaction	1		1	2		2		1		4		1	2		2		1
Shivers	1		2							1			1	1	1		
General collapse				1			1										
Tachycardia												1[1]					
Headache							1			2							
Vomiting								1		1							
Bile in urine					1												
Total number of reactions ..	10	1	15	13	4	21	21	13	5	26	5	5	25	4	27	20	5
Total number of litres given	145	24	134	50	38	257	263	65	62	213	68	17	408	58	241	239	20
Percentage of reactions ..	6·9	4·2	11·3	25·5	10·5	8·2	8·0	20·3	7·5	12·2	7·3	29·4	6·1	6·9	11·4	8·4	25·0

[1] Rh reaction.
[2] Anti-M agglutinin.
[3] Patient sensitive to serum of donor.
[4] Patient suffering from peritonitis and taking "M & B 693".

advanced is that many of the patients received multiple transfusions. If this is the reason, however, it is difficult to understand why it does not also operate in the leuchæmias.

Nature of Reactions in Various Conditions.—From Table V it will be seen that there is no significant difference in the severity of the reactions encountered in the various conditions. It is commonly stated that the most severe reactions are encountered in some of the blood dyscrasias. Our data do not support this statement. Undoubtedly the most serious transfusion reactions are the hæmolytic and the anaphylactic types. Hæmolytic reactions with jaundice occurred in four cases. In two the Rh factor was found to be responsible. The donors' blood was Rh-positive, the recipients' blood was Rh-negative, and the serum of the recipients contained an anti-Rh agglutinin. Both of these patients subsequently received Rh-negative blood without incident. A third patient who developed jaundice was found to have been immunized against the M factor. The patient belonged to group N and was found to have an anti-M agglutinin with a titre of 1 in 32. The development of an immune anti-M agglutinin is rare. Only three other instances have been reported. Details of this case will be reported in a separate communication. The fourth instance of jaundice was encountered in a patient with generalized peritonitis who had received more than 35 grammes of sulphapyridine. This patient subsequently died from metastatic abscesses.

Two anaphylactic or anaphylactoid reactions were reported. One patient, who had suffered from pernicious anæmia for many years, frequently neglected his treatment and reported on numerous occasions with very low red cell counts. For this reason he had received many transfusions over a period of five years. On the particular occasion, after transfusion of 200 mils of compatible blood, he suffered from an acute circulatory collapse with all the signs of an anaphylactic reaction. He gave sensitivity reactions to intradermal injections of the serum of one of the donors. Transfusions of blood were subsequently given without reaction after negative responses had been obtained from intradermal injections of the donors' serum. Later, it was found that the patient had developed hypersensitivity to various liver preparations and shortly after intramuscular injection of one of these preparations had suffered from a similar acute circulatory collapse. The other instance in which an anaphylactoid reaction was reported was unfortunately not investigated.

The type of reaction classified as "pulmonary overloading" was reported in four instances. Two of the patients were anæmic, and the transfusions were administered with the object of supplying red blood cells. The other two litres were administered to a patient suffering from chronic nephritis, and it is presumed that the blood volume of the patient was normal. Inquiry has shown that the blood was administered too rapidly in all three instances. This type of reaction is seen in patients whose blood volume is normal, as for example those suffering from anæmia not due to acute hæmorrhage or from blood dyscrasias. It is well known that it is rare in patients whose blood volume is reduced. There is little risk in administering blood or serum rapidly to such patients.

Urticarial reactions are discussed later in this report.

Nature of the Reaction and the Universal Donor.

Table VI shows the nature of the reactions and their relation to the use of group O blood, both for persons with blood of groups other than group O and for patients whose blood group was not determined.

It will be seen that there was little difference in the nature of the reactions when blood of the same group was used and when group O blood was used for patients of other blood groups.

Incidence of Reactions with Blood Stored for Different Periods.

Table VII shows the percentage of reactions occurring with the use of blood stored for different periods. It will be seen that most of the blood was used within four days of its collection.

TABLE VI.

Type of Reaction.	Total Number of Reactions.	Blood of Same Group as that of the Patient.	Group O Blood, to Patients of Other Blood Groups.	Group O Blood to Patients of Unknown Blood Groups.
Reactions classified as slight	18	15	2	1
Temperature rise	47	35	8	4
Rigors	92	79	9	4
Urticaria	19	16	3	
Anaphylactic reaction	2	2		
Pulmonary overloading	4	3	1	
Jaundice	4	2	2	
Hæmoglobinuria	1	1		
Unspecified reaction	17	12	4	1
Shivers	7	3	3	1
General collapse	2	2		
Tachycardia	1		1	
Headache	3	2		1
Vomiting	2	2		
Bile in urine	1			1
Total	220	174	33	13

The figures in Table VII seem on superficial examination to indicate a progressive decrease in the incidence of reactions as the blood ages. Statistical analysis, however, shows that there is in no instance a significant difference from the mean figure, nor is there any significant difference between the incidence of reactions from blood used on the day of its collection and the incidence of reactions from that used on subsequent days. Reports from time to time have suggested that aging of blood reduces the incidence of reactions.

TABLE VII.

Age of Blood.	Number of Bottles.	Percentage of Total Bottles.	Number of Reactions.	Percentage of Reactions.
Day of collection	329	14·2	37	11·4
One day	674	29·1	67	9·9
Two days	519	22·4	44	8·5
Three days	333	14·4	29	8·7
Four days	174	8·5	13	7·5
Five days	114	4·9	14	12·3
Six days	50	2·2	5	10·0
Seven days	41	1·8	5	12·2
Eight days	44	1·9	2	4·5
Nine days	26	1·1	1	3·9
Ten days	15	0·6	1	6·7

Incidence of Reactions in Various Hospitals.

It was thought that an investigation of the reaction rates in various hospitals might be of interest, in view of the many factors capable of causing transfusion reactions that

TABLE VIII.

Hospital.	Total Number of Flasks Used.	Percentage of Group O Blood Used for Other Groups.	Number of Reactions.	Percentage of Reactions.
Teaching hospital:				
I	261	6·5	13	5·0
II	267	41·0	16	6·0
III	171	11·1	18	10·5
Obstetric hospital:				
I	132	19·7	21	15·9
II	163	15·9	16	9·8
Selected general hospitals:				
I	106	35·8	14	13·2
II	146	10·3	7	4·8
III	120	2·5	7	5·8
IV	302	19·5	17	5·6
V	136	2·2	18	13·2
VI	63	6·4	13	20·6
Suburban private hospitals	137	9·5	24	17·5

are encountered in the hospitals themselves. In all, over 30 public hospitals in the Sydney metropolitan area have been supplied with blood. Table VIII shows the reaction rate at 11 of these hospitals and the rate at private hospitals considered as a whole.

It will be seen that there is a considerable and in most cases a significant difference in the reaction rate encountered in the various hospitals. This may in part be due to more careful observation in some of the hospitals and the consequent reporting of reactions that would have escaped attention in other hospitals. However, this is not the only factor involved in the differences, because the various types of reaction occur in approximately the same proportion at the different hospitals. It is probable that dexterity of administration and particular care in the preparation of giving apparatus do play a part in the incidence of transfusion reactions.

Discussion.

Reactions of Blood Transfusion.

Hæmolytic Reactions.—The hæmolytic reaction is the most serious encountered, in that it may result in death. Fortunately it is now relatively uncommon and will become still less frequent as our knowledge of its ætiology improves. In the present series only three definite and one doubtful reaction of the hæmolytic type occurred. No reactions due to major blood group incompatibilities occurred, and no hæmolytic reaction due to the use of the universal donor was encountered. Further, although 492 litres, or 21·4% of the total blood supplied, was of group A, no hæmolytic reactions were reported which could be attributed to a difference of the subgroups of A. Actually no record of hæmolytic reactions due to the group A and group AB subgroups has appeared in the literature, although Wiener[13] has reported the development of immune agglutinins against the subgroups.

Anaphylactic Reactions.—In two cases of the series acute circulatory collapse of the anaphylactic type developed. It is probable, however, that some of the less serious reactions were due to a sensitivity of the recipient to allergens or atopens in the donors' blood. Intradermal tests with the donors' serum gave positive responses in a number of cases investigated. Further, it is probable that sensitivity to the donors' serum is more frequent in patients who receive repeated transfusions, and especially if the same donor is used more than once. Maunsell[10] has recently shown the role of atopens in the causation of transfusion reactions. It seems that the anaphylactoid reaction described earlier is an example of this atopic sensitivity, with resulting desensitization of the recipient. The allergic aspect of transfusion reactions is a subject which requires a great deal of investigation and may account for at least some of the pyrexial reactions and rigors which occur after transfusions.

Urticarial Reactions.—Nineteen instances of urticarial reactions were reported. The occurrence of urticaria after blood transfusion has been observed by several workers, and attempts have been made to explain the mechanism of its production. Of the 19 instances in the present series, however, 11 occurred during a period when sodium sulphathiazole was being added to the stored blood. This drug was added in a concentration of 1 in 2,000 parts as a result of the work of Jensen,[11] who found that the growth of microorganisms which grow at low temperature was inhibited by the drug. The incidence of urticaria increased considerably coincidentally with the addition of sulphathiazole to blood. The reactions encountered were alarming in their severity. The urticaria was as a rule generalized, and the weals were often confluent. No instance of laryngeal œdema was reported, but facial œdema was seen in four instances. The patients all complained of intense itching of the skin. A history of previous or simultaneous administration of a sulphonamide drug was given by some, but the majority had never previously received sulphonamide therapy. Because of the incidence and the severity of the urticaria, the addition of sulphathiazole to blood was discontinued. The production of urticaria by blood containing sulphathiazole is not clearly understood. Some of the patients who reacted, subsequently gave positive responses to intradermal injections of plasma containing sulphathiazole, but not to sulphathiazole solution or to plasma without sulphathiazole. Others gave negative responses to all these solutions.

Circulatory Reactions.—Transfusion therapy plays an important role in the blood dyscrasias and in the preoperative care of surgical patients. The necessity of slow administration of blood to patients with a normal blood volume has been explained by many writers, and the dangers of circulatory overloading have been stressed. As a result of the interest aroused by Marriott and Kekwich,[9][10] massive transfusions have become popular, but their dangers have unfortunately not been fully realized. Apart from the four instances of frank circulatory overloading already mentioned, it is probable that a number of the rigors which occurred among patients with anæmia were due to the too rapid administration of blood.[13] Whilst there is little danger of circulatory overloading from the rapid administration of blood or serum to patients whose circulatory blood volume has been reduced, blood cannot be administered too slowly to patients suffering from blood dyscrasias, especially if myocardial weakness is present. It is possible that lack of consideration of this factor has been partly responsible for the impression that reactions are both frequent and serious in certain blood dyscrasias. However, the practice of giving multiple transfusions to such patients is conducive to the development of immune agglutinins and protein sensitivity.

Pyrogenic Reactions.—The subject of pyrogens is complex; but that such substances are a frequent cause of transfusion reactions was well shown by the experience at the Mount Sinai Hospital.[17] This hospital reduced the incidence of transfusion reactions from 23% to less than 13% by close attention to the technique of cleansing and sterilizing of apparatus. Great care to avoid pyrogens is exercised in the preparations of solutions, flasks and taking apparatus. Distilled water is used on the day of its distillation for the washing of apparatus and the preparation of solutions, and all solutions and washed apparatus are autoclaved immediately after preparation. In spite of the strict *régime*, however, it is by no means impossible for the ubiquitous pyrogen to be present. At the same time, it is known that many hospitals do not pay sufficient attention to their giving apparatus. Blood is allowed to remain in the giving sets for a considerable time, washing is hurriedly performed, old distilled water is frequently used, a considerable interval often elapses between the cleansing of apparatus and its sterilization, and finally, autoclaves are more commonly imperfect in their operation than is realized. In those hospitals where attention is paid to these details the reaction rate has been low. It must be realized that the control of pyrogenic reactions rests to a large extent with the hospital or medical practitioner administering the blood.

Reactions Due to Other Causes.—Other factors causing blood transfusion reactions are numerous, and some can be only briefly mentioned here. Reactions due to impurities in the solutions are minimized by the use of good quality chemicals. It is known that clot formation in collected blood will render it toxic, just as it was found that defibrinated blood was too toxic for general use. The presence of small clots in a flask of blood is difficult to detect, but they are often responsible for reactions. Even the use of a blood filter in the giving set will not remove their noxious influence. Similarly, hæmatoma formation due to difficulty in venepuncture either in the donor or in the recipient may be responsible for pyrexial reactions. Finally, undue venous congestion in the arm or leg of the recipient caused by prolonged application of a tourniquet may result in venous stagnation, with adverse effects on the recipient. Even in normal persons venous tourniquets may cause fainting and nausea if applied for too long a period.

The Use of the Universal Donor.

Considerable controversy has centred on the dangers of the universal donor. The International Congress of Paris in 1937 declared that the indiscriminate use of the universal donor was dangerous. According to a regulation of

the Sanitary Code of New York State, of June 26, 1941, "only those group O individuals may be used as donors whose isoagglutinins have proved to be of low titre by actual titration".[7] Various workers have made recommendations to minimize the associated risk. Those of Gesse[12] are probably the most rigid. They are as follows: (i) Not more than 100 to 200 mils of universal donor blood should be transfused. (ii) The erythrocyte and hæmoglobin content of the recipient's blood should be determined, transfusions of universal blood being permissible when the red cell count is above 2,000,000 per cubic millimetre. (iii) The titre of the donor's serum for the recipient's cells must be determined and the blood used only when the titre is 1:8 or 1:16.

On the other hand, Aubert, Boorman, Dodd and Loutit[9] gave to 12 recipients of blood group A plasma containing agglutinins of great potency, and no evidence was obtained that the iso-agglutinins in group O blood are responsible for severe or fatal hæmolytic reactions. According to Riddell,[10] the organization *Transfusions Sanguines d'Urgence* in Paris supplies blood for over 6,000 transfusions each year. Most of this blood belongs to group O and no fatal reactions have been reported. In 1930 Brines[11] recorded the administration of 4,000 transfusions mostly of group O blood without a fatality. The value of the last two series has been criticized, however, on the ground that only relatively small amounts of blood (300 to 500 mils) were transfused. In the present series 356 litres of group O blood were administered to patients of other groups and 195 litres to patients whose group was not determined either before or after the transfusion. No serious reaction attributable to the use of this blood was reported, and the incidence of reactions was not greater than when blood of the same group as that of the patient was transfused.

The discovery of the Rh factor and the role that it may play in transfusion reactions necessitates a reexamination of the reports in which the universal donor was alleged to be responsible for the reaction. In 1942 Rosenthal and Vogel[6] reviewed 50 such reports. In many instances insufficient information was available to permit a reassessment in the light of recent knowledge. In others the transfusions were administered in the course of or after pregnancy, and the Rh factor may have been involved. Further reactions occurred in patients who had received multiple transfusions, whilst still others were reported to have followed the administration of very small quantities of blood, amounts too small to produce hæmolytic reactions. Rosenthal and Vogel conclude that transfusions with universal donor blood are not followed by any greater number of reactions than are transfusions with homologous blood. The reaction alleged by de Gowin[8] to have been caused by the use of group O blood occurred in a parturient woman and may have been due to an Rh immunization of the mother by the fœtus.

There are, however, three aspects of the use of universal donor blood that must be examined before widespread usage can be recommended. They are as follows: (i) Is group O blood dangerous when administered to patients of other blood groups? Will it cause hæmolytic reactions, or will the incidence of minor reactions be greater than when homologous group blood is used? (ii) Are there advantages in using group O blood? (iii) Will group O red cells survive in a patient of another blood group for as long as will cells of the homologous group?

1. Available evidence appears to indicate that hæmolytic and other reactions due to the use of the universal donor are rare. It seems that the majority of reported cases of hæmolytic reactions must be disregarded in view of other possible explanations that have since been discovered. However, the following reaction was probably due to the use of group O blood.

The patient, a male, aged forty-eight years, was suffering from recurrent osteomyelitis of the femur and ilium. He had received three transfusions in the previous twelve months, two of group A blood and one of group O blood. No reaction was noted on any occasion. On the particular occasion he was given a transfusion of 500 mils of group O blood collected from his brother. During the transfusion the patient experienced a severe rigor with rise of temperature and complained of lumbar pain. Next day he was observed to be jaundiced, and bilirubinuria was present. The patient's blood was found to belong to group A, subgroup A_1, and to be Rh-positive. No irregular agglutinin was found in his serum, nor did his serum agglutinate the donor's cells. The donor's blood was group O, Rh-positive. The α agglutinin in his serum was present in a titre of one in 2,048 and the β agglutinin in a titre of one in 1,024. The patient subsequently received a transfusion of group A blood without reaction. Although other factors may have been operative, no evidence as to their nature was obtained and it is assumed that the use of the group O blood was responsible for the hæmolytic reaction.

This instance is the only one that has come to the notice of the writer, but it is not included in the series in this report.

Aubert, Boorman, Dodd and Loutit[9] found in the experiments already mentioned an increase in the serum bilirubin of the patients of blood group A, indicating some destruction of the recipients' red cells. No frank hæmolytic reactions were noted.

The rarity of serious reactions and the low incidence of minor reactions following the use of group O blood were probably due to two factors. Firstly, the mixing of the blood of two group O donors in the one flask, which is our practice, minimizes the risk of exceptionally high agglutinin titres, because the chances are not great of finding two group O donors whose agglutinin titres are as high as those of the donor encountered by the writer. Secondly, the extracorpuscular agglutinogen or group-specific substance present in the majority of persons (secretors) exerts some protective influence against the corresponding agglutinin. It would seem that those persons who lack this substance (non-secretors) are more susceptible to reactions when given transfusions of group O blood than are the secretors.

Many workers have suggested that the agglutinin titre of group O donors should always be determined, and that those whose titre exceeds a certain level should not be used as universal donors. It is questionable, however, whether such a laborious procedure is necessary in view of the rarity of serious reactions and of the probable safeguard afforded by the mixing of the blood of two donors. Further, the diversity of results obtained when different techniques are employed makes the determination of a safe titre very difficult. What might be considered a safe titre for a patient who is a secretor may be dangerous for a non-secretor.

It has been questioned whether group O cells may act as foreign proteins and so cause the development of immune antibodies which are not demonstrable by ordinary techniques, or may induce a state of sensitivity leading to allergic or anaphylactic reactions. If such a phenomenon does occur, the evidence suggests that it does so only infrequently and that its consequences are not serious.

Aubert and his co-workers recommend that when a transfusion is designed to raise the recipient's red cell count homologous group blood should be given if available; but in an emergency, when restoration of the blood volume of the recipient is the chief aim, the use of the universal donor is justified. The present writer is in agreement with these recommendations, but considers that in some circumstances the use of group O blood to increase the red cell count is also justified. The reasons for this qualification are discussed among the advantages of group O blood.

2. The storage and use of group O blood will minimize wastage in a blood bank. Unless the turnover is large, collected group B or group AB blood will not be used before the expiry dates and must therefore be discarded. Use of the supernatant plasma for the preparation of serum is unsatisfactory. The inevitably high calcium content of serum prepared from citrated plasma is undesirable, and the metabolic changes which take place in the blood during storage result in electrolytic and leucocytic changes in the plasma. Further, if serum is prepared from fresh blood, the pooling of group A, group B and group AB blood is desirable to reduce the agglutinin titre of the final product. Jakobowicz and Bryce[13] have shown that a predominance of group O serum in a pool may result in a high agglutinin titre.

From the patient's point of view the use of group O blood avoids major blood group incompatibilities. No accidents due to incorrect grouping of a patient's blood occurred in the present series, but one has been encountered by the writer. This patient belonged to blood group O, but his blood was incorrectly grouped as belonging to group B, and he received 860 mils of group B blood. A severe non-fatal hæmolytic reaction followed. Mistakes in blood grouping can be avoided with care, but are not uncommon when the tests are performed by inexperienced personnel. Except when experienced personnel are available to perform the preliminary tests, the use of group O blood for all patients is considered the safest procedure. Moreover, the availability of group O blood should, especially in cases of emergency, encourage its use.

3. The experiments of Aubert and his co-workers indicate that some at least of the recipient's red cells may be destroyed after the administration of group O blood. Except in rare instances, however, this cell destruction is not sufficient to cause jaundice or hæmoglobinuria or to result in a significant reduction in the red cells count of the patient. On the other hand, there is evidence that the group O cells themselves survive for as long a period in a person of blood group A as do group A cells. Ashby's finding[34] that group O cells survive in a recipient of blood group A for 90 to 114 days is in close agreement with the finding of a similar survival time of cells of the same ABO group by Wiener.[33] This worker differentiated between donors' and recipients' cells by M and N agglutination.

The Use of Stored Blood.

A prejudice against the use of blood collected more than a few hours previously is evident amongst certain medical practitioners. This prejudice owes its origin to earlier reports of reactions from the use of stored blood and also of the risks of infection of the blood. The knowledge that the older the blood, the shorter the survival time of the red cells in the patient, has encouraged medical practitioners to request freshly collected blood for all conditions. Actually, if infection is eliminated, as it apparently has been, the incidence of reactions is not greater when the blood has been stored than when it is freshly collected. It is, of course, desirable to use freshly collected blood for patients with anæmias and blood dyscrasias. On the other hand, the use of stored blood fulfils all requirements when blood volume restoration is of paramount importance and increase of the oxygen-carrying capacity of the blood of secondary importance. Even in the blood dyscrasias Whitby[36] has suggested that transfusions of stored blood may provide a hæmatopoietic stimulus with resulting beneficial effects. He considers that anæmia is not a contraindication to the use of stored blood if freshly collected blood is not available. Finally, lest storage of blood be considered too lightly, it is desired to stress that infection can be avoided only if the collection is carried out under ideal conditions and with a due regard for the necessity of attention to detail.

The Rh Factor in Blood Transfusions.

The subject of the Rh factor in blood transfusions can be discussed only briefly. In the present series the Rh factor was incriminated as a cause of transfusion reactions on four occasions. In two instances its involvement was detected after a hæmolytic reaction, and on the other two occasions after rigors. In one instance the patient was subsequently found to have a history of giving birth to children with hæmolytic disease, and the other three patients had all received multiple transfusions. In one instance the Rh factor was not involved until a reaction had occurred twice. The first reaction was relatively mild; the second was a severe rigor, but no obvious hæmolysis occurred.

It would appear that the importance of the Rh factor as a cause of transfusion reactions has been exaggerated. Reactions due to the factor occur only in women with Rh-negative blood who have been immunized against the factor by pregnancy, and in patients with Rh-negative blood who have been immunized by multiple transfusions of Rh-positive blood. Careful inquiry will usually detect the former. The proportion of patients who receive multiple transfusions over a period of time is small, and of these only 15% are exposed to the danger of Rh immunization by virtue of the fact that their blood is Rh-negative. Further, it would seem that with relatively few exceptions many transfusions are necessary to produce immunization of a patient with Rh-negative blood and that reactions progressively increasing in severity give adequate warning of the necessity for investigation of the Rh position to avoid a fatal or nearly fatal reaction. In view of these considerations it is not surprising that reactions due to the Rh factor constitute only a small percentage of the total number of reactions.

Summary.

1. An analysis of the use of 2,386 litres of blood is presented. The reactions which occurred are discussed and the indications for transfusion are listed.

2. The contention that group O blood is dangerous for transfusion to patients of other blood groups was not substantiated by the analysis. The alleged dangers of such a practice are examined in the light of recent knowledge.

3. The Rh factor was found to be an infrequent cause of transfusion reactions.

4. The dangers of rapid transfusion to patients with a normal blood volume are stressed.

5. No evidence was obtained to indicate that certain diseases render recipients susceptible to transfusion reactions.

6. Sensitivity and pyrogenic reactions are discussed.

Acknowledgements.

The writer wishes to acknowledge the assistance of Dr. A. H. Tebbutt and the permission of the Director-General of Medical Services to publish this report.

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Appendix.

Cases of Primary Anæmia, Blood Dyscrasia and Anæmia Secondary to Other Conditions.

Pernicious anæmia	65	Myelosclerosis	2
Macrocytic anæmia	4	Thyreotoxicosis	2
Achrestic anæmia	5	Secondary to burns	7
Secondary anæmia	39	Acute yellow atrophy of the liver	1
Hypochromic anæmia	23	Acholuric jaundice	1
Hæmolytic anæmia	12	Agranulocytosis	20
Anæmia of pregnancy	10	Hodgkin's disease	1
Puerperal anæmia	12	Leuchæmia—	
Aplastic anæmia	67	Monocytic 5	
Anæmia of malignant hypertension	2	Lymphatic 20	
Anæmia of chronic nephritis	12	Myeloid 15	
Unspecified anæmia	84	Aleuchæmic 24	
Poisoning—		Unspecified 4	
Benzol	1		68
Cresol	1	Reticulo-endotheliosis	2
General paralysis of the insane — malaria therapy	2	Purpura	6
		Hæmophilia	11
Total			460

Cases of Hæmorrhage.

Post-partum	145	From ruptured hymen	1
Placenta prævia	14	Traumatic	14
Ante-partum	24	Hæmatemesis	257
Following Cæsarean section	21	Hæmoptysis	3
Hydatidiform mole	4	Epistaxis	13
Ruptured uterus	6	Hæmaturia	4
Incomplete miscarriage	134	Hæmorrhoids	8
Septic miscarriage	17	Hæmoperitoneum	3
Septic miscarriage with septicæmia	33	Ruptured duodenal ulcer	2
After curettage	5	Post-tonsillectomy	24
Ectopic gestation	38	Small bowel obstruction	1
Gynæcological origin	109	Unspecified	31
		From tooth socket	1
Total			912

Cases of Pre-Operative and Post-Operative Care.

Gynæcological operations—		Orthopædic operations	9
Hysterectomy	43	Gall-bladder operations	14
Other operations	6	Traumatic operations	69
Gastro-intestinal operations	30	Appendiceal abscess	5
Thyreoidectomy	2	Mastectomy	3
Thoracic operations—		Mastoidectomy	3
Thoracoplasty 16		Glands of neck	1
Patent *ductus arteriosus* 14		Herniorrhaphy	1
Lobectomy 12		Volvulus	2
Coarctation of aorta 1		Laparotomy	3
	43	Berger's disease	1
Cranial operations	9	Ischio-rectal abscess	2
Urological operations—		Cleft palate operation	1
Ruptured kidney 1		Removal of tumour of upper lip	1
Renal operations 21		Unspecified pre-operative and post-operative care	75
Prostatectomy 42		Appendicectomy	1
	64		
Intestinal obstruction and ileus	18		
Total			406

Cases of Infection.

Septicæmia of obstetric origin—		Acute nephritis	2
Anaerobic streptococcus 7		Pyelitis	3
Hæmolytic streptococcus 3		Cholangitis	1
Bacterium welchii 10		Pancreatic abscess	5
Not specified 6		Empyema of gall-bladder	1
	26	Peritonitis	12
Puerperal infection	15	Pelvic peritonitis	15
Pyelitis of pregnancy	3	Psoas abscess	1
Septicæmia (other than obstetric)	32	Gangrenous appendix	1
Osteomyelitis	24	Gas gangrene of leg	2
Pulmonary tuberculosis	22	Symbiotic gangrene	1
Lung abscess	12	Rheumatoid arthritis with anæmia	13
Pneumonia	8	Infective arthritis	5
Unresolved pneumonia	4	Rheumatic carditis	3
Empyema	19	*Erythema multiforme*	1
Bacterial endocarditis	11	Infected hæmatoma	1
Meningitis	5	Fungoid disease of the lung	2
Cerebral abscess	3	Diabetic gangrene	3
Ulcerative colitis	14	Arteriosclerotic gangrene	1
Diverticulitis	2	*Cancrum oris*	1
Total			274

Cases of Carcinoma.

Stomach	73	Tongue	1
Œsophagus	3	Epithelioma of face	1
Gall-bladder	1	Rectum	28
Bladder	6	Uterus (known to be carcinoma)	26
Prostate	4	Sarcoma of leg	1
Pancreas	6	Glands of neck	1
Breast	12	Pulmonary neoplasm	10
Colon	66		
Total			239

THE Rh FACTOR: A SURVEY OF THE SUB-TYPES OF WHITE AUSTRALIANS.[1]

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SOON after Landsteiner and Wiener's discovery of the Rh factor (1940, 1941), the latest agglutinogen found in the red cells of man, and its corresponding antibody in serum, it was realized that human anti-Rh sera differed in their specificity, and that, with the aid of antisera which showed different agglutinative properties, it was possible to distinguish qualitative differences of the Rh antigens in human erythrocytes—that is, to determine the various sub-types of Rh-positive cells.

The current theory of the Rh antigens supposes that there are six or more allelomorphic genes, and these, unfortunately, have been given a variety of names, owing to their complexity and order of discovery.[2] For the purposes of this paper the nomenclature used is that adopted by Wiener (1944) and slightly modified by Snyder (1945). The antigens, partial antigens and their antibodies can be described as follows.

The Rh Antigens in Human Erythrocytes.

Rh°.—Until recently the Rh° antigen has been known as Rh, Rh_0, or the Rh factor; but after the discovery of the Rh sub-types it was renamed Rh_0, or Rh°, as Rh was taken to have a much wider meaning. This is the antigen common to the rhesus monkey and to about 85% of white people. It appears to be the antigen responsible for the agglutinating antibody Rh°, and for the blocking antibody (see below) which so far has been found to be specific against the Rh° element in the erythrocytes. In whites it usually occurs in combination with another partial antigen, but uncombined, its occurrence in whites in New York City was given by Wiener, Unger and Sonn (1945) as 2·4%, whereas the figure in England (Taylor and Race, 1944) and Australia (present survey) is under 1%. On the other hand, Wiener, Belkin and Sonn (1944) found that among selected American Negroes the percentage of Rh° was as high as 41·6 and among unselected Negroes 24·5%. Almost identical differences between white and coloured subjects have been observed by Levine (Waller and Levine, 1944).

Rh'.—Occurring alone, Rh' is a rare sub-type (1·0% according to Wiener *et alii*, 1945); but in combination with Rh° it is found in 70% of whites and was previously designated Rh_1; now, to avoid any ambiguity, and to be consistent with modern genetic terminology, it is named Rh°'.

Rh".—Rh" is a very rare sub-type when occurring alone, but combined with Rh° it is found in 30% of whites; it was called Rh_2, and is now named Rh°".

All of the three types, Rh°, Rh' and Rh" react specifically with their corresponding antibodies.

rh.—The Rh-negative genotype is given as rhrh. The rh gene is recessive, so that when combined with any of the above-mentioned Rh-positive genes, the resulting geno-

[1] Submitted for publication on July 3, 1945.

[2] An international committee on which Australia is represented is now discussing the nomenclature of human blood genes.

type will be a heterozygous Rh positive; for example, $Rh^{o'}rh$ or $Rh^{o''}rh$. In whites the Rh negative (rhrh) occurs in approximately 13% of all persons, whereas in American Negroes it is found in about 7·3%. In other races it has been shown to be absent or very rare—for example, Australian aborigines, Chinese, Indonesians, Japanese, Fijians, Papuans and others (Simmons, Graydon and Barnes, 1945).

Rh_7 and Rh_8.—Rh_7 and Rh_8 genes have been described, but they are very rare (Race *et alii*, 1944; Murray *et alii*, 1945). The reactions of Rh_8 are known, but those of Rh_7 have yet to be determined.

The Rh Antibodies in Human Serum.

The immune response to any of the above-mentioned antigens varies from person to person. Indeed, a considerable proportion of persons show no detectable response at all when subjected to possible iso-immunization. This is in part the explanation why, when the calculated frequency of matings between males with Rh-positive blood and females with Rh-negative blood is 9%, according to Javert (1942) hæmolytic disease of the newborn occurs in approximately one in 400 births. This apparent inability of many "Rh-negative" mothers to become immunized is therefore of significance in the prognosis in potential cases, and the outlook is not so bad as would otherwise be expected. Further, the type of immunity response also varies, and in one type (St) (McCall *et alii*, 1944) the response appears to bear only a partial relationship to the antigenic stimulus.

The Rh^o Antibodies.

Recent important work by Wiener (1944) in America and by Race and Taylor in England (Race, 1944) has shown that the Rh^o antibodies are of two kinds. They are known as the agglutinating and the blocking (or incomplete) antibodies.

The Agglutinating Antibody.—The agglutinating antibody, anti-Rh^o, has been variously designated as anti-Rh, anti-Rh 85%, standard, anti-Rh_o, serum 3 and Δ (delta). It can be obtained by the immunization of rabbits or guinea-pigs with rhesus monkey cells, but in addition it is the most commonly found antibody when a subject with Rh-negative blood is immunized by the cells of a person with Rh-positive blood, whether by transfusion or in obstetrical cases. Anti-Rh^o agglutinates all cells containing Rh^o either alone or combined. (See Table I.)

The Blocking Antibody.—The blocking antibody, which has only recently been recognized, is of extreme importance. In the first place it cannot be detected by the usual agglutinating technique; secondly, it can exert a lethal effect upon the child of a mother whose serum contains it, and may cause hæmolytic reactions from transfusions of apparently compatible blood; thirdly, it may occur together with the agglutinating antibody in the same person's serum and may mask the presence of the agglutinating antibody; and finally, it is regarded as having some effect in the prozone phenomenon. In a high percentage of cases of hæmolytic disease of the newborn, an agglutinating antibody can be demonstrated; but the blocking antibody will probably be found to be responsible for many of the remaining cases. The danger of the blocking antibody lies in the difficulty of its detection. For transfusion purposes cross-matching will not detect the blocking antibody, and its suspected presence will necessitate the full test. Wiener's test is to mix one drop of a 2% suspension of known Rh-positive cells (of sub-type $Rh^{o'}$ or $Rh^{o''}$) and one drop of the serum to be tested in a suitable tube, and to allow the mixture to stand in a water bath at 38° C. for thirty to sixty minutes. Then a drop of active anti-Rh^o agglutinating serum, suitably diluted, is added, and after an additional incubation at 37° C. for thirty to sixty minutes the reaction is read. If blocking antibodies are present, no agglutination will occur or the expected clumping will be much weakened. To appreciate the action of the blocking antibody, it can be regarded as an incomplete antibody, which itself does not cause agglutination, but which places a protective coating on the cell to inhibit the action of the agglutinating anti-Rh^o antibody. It should be noted that so far it has been found to be specific only in inhibiting anti-Rh^o agglutinating antibody, anti-Rh′ and anti-Rh″ antibody being unaffected by it. To unmask the presence of an agglutinating antibody in a specimen of serum suspected of containing both agglutinating and blocking antibodies, it has been found that the latter may be absorbed or partly absorbed by the addition of washed, defibrinated sheep, horse or other animal cells by incubation for sixty minutes at 37° C.

The absorbed serum is then tested in the usual way for agglutinating antibodies. Blocking antibodies may also be absorbed with appropriately chosen human cells, but in our hands the sheep or horse cells have been more satisfactory, as in most laboratories they are more easily obtained than the correct human cells. It remains to be discovered whether the blocking antibody arises in response to the anti-Rh^o antigen or whether it arises in response to immunization by a special antigen of its own. Wiener has shown that it is possible to make use of the specificity of blocking antibody, which is anti-Rh^o, by adding it to a strong polyvalent antiserum—for example, anti-Rh^o,Rh′—to mask the anti-Rh^o agglutinin, leaving an active sub-type anti-Rh′ serum. This is the method now recommended by Wiener for the preparation of monovalent sub-type serum from polyvalent antiserum.

Anti-Rh′ and Anti-Rh″.—So far as is known, anti-Rh′ and anti-Rh″ antibodies are always of the agglutinating type. They do occur in the pure form, but are found most frequently in association with anti-Rh^o as anti-$Rh^{o'}$ and anti-$Rh^{o''}$. The removal of the anti-Rh^o agglutinin may be accomplished as outlined above, by simple dilution, or with serum containing anti-Rh^o blocking antibody, or by absorption with the appropriate human cells.

Anti-Hr or St.—The first serum of the anti-Hr or St type, a weak serum, was found by Levine and Javert (1941). The mother's blood was Rh-positive and her serum contained the so-called anti-Hr agglutinin. The next serum of this type, which was similar but not identical, was reported by McCall *et alii* (1944). This serum was called St; in this case the genotype of the mother's blood was $Rh^{o'}Rh^{o''}$, the blood of the father, the baby and older living child was all of the genotype $Rh^{o'}rh$. This serum reacted with the blood of 80% of white people, including all the Rh-negative type, all the heterozygous Rhrh types and some of the homozygous Rh-positive RhRh types. By the use of this serum in conjunction with anti-Rh^o, anti-Rh′ and anti-Rh″ serum, it is possible within limits to determine serologically the genotype of about 80% of white people. Other sera of the same type have been found by Taylor and Race. A peculiarity of the St antibody is that the immune response in the mother does not correspond with the antigenic stimulus. In the case of St and a later identical serum—(G), (Taylor, personal communication)—each mother's blood was $Rh^{o'}Rh^{o''}$ and that of each baby $Rh^{o'}rh$. St antiserum reacts with blood properties determined by the genes $Rh^{o''}$, Rh″, Rh^o and rh, but not with the blood factors determined by the genes $Rh^{o'}$ and Rh′. This has been confirmed by Wiener, Davidsohn and Potter (1945), and in the present survey. Thus St antibody agglutinates all cells except those of $Rh^{o'}Rh^{o''}$ and Rh′Rh′ (Rh_o being neglected). The property of St serum to agglutinate rh is utilized in differentiating homozygous and heterozygous blood of $Rh^{o'}$ phenotype. Thus homozygotes $Rh^{o'}Rh^{o'}$ are St-negative, while the heterozygotes $Rh^{o'}rh$ are St-positive. St serum is therefore useful in some cases in which it is desired to determine the chances of a father to produce children unaffected by erythroblastosis, when the mother's blood is Rh-negative and she is already immunized against Rh. Homozygous fathers mated to mothers with Rh-negative blood must always have heterozygous offspring with Rh-positive blood, whereas heterozygous fathers have an even chance of producing children with Rh-positive or Rh-negative blood; the "Rh-negative" children, having blood compatible with that of the mother, will therefore be unaffected.

Other Types of Antiserum.—Other rare types of antiserum have been described.[1] For instance, one found by

[1] See also articles by A. E. Mourant, by R. R. Race *et alii*, and by R. A. Fisher, *Nature*, Volume CLV, May 5, 1945, page 542.

Stratton (1944) contained agglutinins anti-Rh°, anti-Rh′, anti-Rh″. Taylor and Race (1944) state that they know of the occurrence of another serum of this sort, but the presence of a residual antibody from a previous immunization should be excluded.

Comment.—Race, Taylor, Ikin and Prior (1944) have suggested that the simple designations R and r be used instead of Rh and rh, the adoption of which, as Snyder (1945) points out, would be in line with the nomenclature of the antigens A, B, M, N and P. With the aid of the types of antiserum enumerated above, it is now possible to determine with a fair degree of accuracy the Rh subtype of many blood samples. The agglutination reactions given by the various Rh sub-types and the different nomenclatures suggested by Wiener (1944), by Race *et alii* (1944) and by Snyder (1945) are shown in Table I.

TABLE I.
Reactions of the Subtypes of Rh and the various Nomenclatures Suggested.

Reactions with Rh Antiserum.			Nomenclature Suggested by		
Anti-Rh° (84·0%)	Anti-Rh′ (70·0%)	Anti-Rh″ (30·0%)	Wiener (1944)	Snyder (1945)	Race *et alii*. (1944)
+	+	−	$Rh_1(Rh_o')$	$Rh^{o'}$	R_1
+	−	+	$Rh_2(Rh_o'')$	$Rh^{o''}$	R_2
+	+	+	Rh_1Rh_2 $(Rh_o'Rh_o'')$	$Rh^{o'}Rh^{o''}$	R_1R_2
+	−	−	Rh_o	Rh^o	R_o
−	+	−	Rh′	Rh′	R′
−	−	+	Rh″	Rh″	R″
−	+	+	Rh′Rh″	Rh′Rh″	R′R″
−	−	−	Rh-negative	Rh−	R-negative

The Present Investigation.

This paper presents the results obtained from tests of the blood of 350 white Australians for the Rh sub-types.

Materials and Methods.

The Rh typing was performed by us in three different laboratories on 350 blood samples of groups O and A only. The blood specimens were not entirely a random sample of the two blood groups, as three families were included in the series.

The tests were carried out with anti-Rh typing serum kindly supplied for the purpose by Dr. A. S. Wiener, New York, and Dr. G. L. Taylor, Cambridge, England. The laboratory which used the American typing serum carried out 125 tests by the tube technique as recommended by Dr. Wiener. The English anti-Rh typing serum was received in the dried state, and for use it was dissolved in sterile distilled water and made up to the original volume. In preliminary tests it was found that these specimens gave good agglutination with the appropriate erythrocytes when tested by the slide technique as used by Simmons *et alii* (1943). The antiserum was then used at the optimal dilutions which gave satisfactory agglutination, and 225 tests on blood samples were performed on slides in two different laboratories. A number of control blood samples were tested by both tube and slide technique and identical results were obtained. All results which were recorded as "negative" when read with a hand-lens were checked microscopically; but readings were always identical. We also received a sample of St (anti-Hr type) serum labelled (G) from Dr. Taylor, and with this serum the same 225 blood samples were tested by the slide technique. All samples of blood were tested within twenty-four hours of collection, but some samples which had been stored for five months at 38° F. in a modified Rous and Turner solution containing "Merthiolate" (1 in 100,000) were also tested (*vide infra*). This red cell preserving solution has been used for many blood group surveys carried out in Melbourne, and its preparation and use have been described by Simmons and Graydon (1945).

Results.

The results of the Rh sub-type tests on 350 blood samples are shown in Table II; 225 blood samples were tested by the slide technique and 125 blood samples by the tube technique; the number and percentages of the Rh sub-types found are presented separately. It will be seen that the results obtained by either technique and with different sub-type antiserum show no significant difference. Tests made with St serum on 225 blood samples showed that 171 (76·0%) samples were St-positive and 54 (24·0%) were St-negative. The St reactions obtained with the various Rh sub-type erythrocytes confirm the work of Race *et alii*, 1944.

During this survey we encountered erythrocytes of a rare Rh sub-type (not included in Table II). This person's cells were agglutinated by the typing sera anti-Rh°, anti-Rh′ and anti-Rh″. No agglutination was obtained with St serum. According to Murray *et alii* (1945), this person's cells would be named Rh_o, but according to Taylor and Race (1944) they would be classed as Rh_1Rh_2. This person's daughter was found to have $Rh^{o'}Rh^{o''}$ blood; that is, she was homozygous, tests giving negative results with both anti-Rh″ and St serum.

Discussion.

In Table II are shown also the combined results for the present survey, and American and English figures are quoted for comparison. The percentages of the Rh sub-types found in the three countries are generally in close agreement, but our percentage for sub-type Rh° is 0·57% compared with 2·4% found in America; our Rh-negative percentage is 14·86%, compared with 13·3% for American whites. In a large series of tests performed when an Rh-negative donor pool was being established in Melbourne, we found the Rh-negative percentage to be higher than 14·86%. Simmons *et alii* (1943), in over 3,000 tests, found 16·6% of the samples of blood to be Rh-negative. (Samples tested with anti-Rh° serum only gave an Rh-negative percentage of 17·6, the difference of 1·0% representing sub-type Rh′.)

Jakobowicz and Bryce (1944), continuing the series with over 5,000 tests, reported finding 16·8% of blood samples to be Rh-negative. Recent figures for a total of 10,000 random samples of blood from Red Cross donors in Melbourne tested with anti-Rh° and anti-Rh°,Rh′ serum indicate that the blood of approximately 16·4% of the persons tested was Rh-negative. No sample of anti-Rh″ serum, either alone or combined with anti-Rh°, has so far been encountered in our laboratories; but had anti-Rh″ serum been used in the above Rh testing, the number of persons found whose blood contained the agglutinogen Rh″ would not have altered appreciably the Rh-negative percentage of 16·4. It is interesting to note that Race *et alii* (1944) found, in a small series in England, an Rh-negative percentage of 16·59, but stated that this percentage was slightly higher than that found in a much larger sample. Race, Taylor, Boorman and Dodd (1943) reported 15·36% persons with Rh-negative blood in 4,618 tested. The Australian and English percentages, therefore, do not greatly differ, but are higher than the Rh-negative percentage found in America for white persons.

During this survey we had an opportunity of testing a number of sterile blood samples which had been stored for five months at 38° F. in the slightly modified Rous and Turner glucose-citrate preserving solution (two drops of blood to one ml of solution). The samples showed no hæmolysis and were not pan-agglutinable. Rh tests for sub-types were carried out on slides on these samples, and another set of tests was carried out in another laboratory by Miss D. Nicholas, of Perth, Western Australia, on fresh samples of blood from the same persons. The results of the two sets of tests were identical. The results obtained show that Rh tests can be satisfactorily performed on old, sterile blood samples suitably preserved, and that the ability of the Rh agglutinogen to agglutinate with the appropriate antiserum is not rapidly lost, as many workers have suggested. It is, of course, not recommended that Rh tests, or tests for blood groups or types, be attempted on samples of blood which are hæmolysed or contaminated by bacteria. The possibility of pan-agglutination can easily be excluded by the use of normal human serum of group AB as control testing serum.

TABLE II.

The Rh Sub-types in Australian Whites, American Whites and English.

Rh Sub-type.	Genotypes. (Incomplete.)	Present Survey. 225 Tested.[1]				Present Survey. 125 Tested.[2]		Combined Results. 350 Tested.		American Whites.[3] 1,468 Tested.	English (Small Series.)[4]	English.[5] 927 Tested.	
		Number.	Percentage of Sub-types.	St-Positive.	St-Negative	Number.	Percentage of Sub-types.	Number.	Percentage of Sub-types.			Number.	Percentage of Subtypes.
$Rh^{o'}$ ..	$Rh^{o'}Rh^{o'}$ $Rh^{o'}rh$	124	55·12	0 71	53 0	65	52·0	189	54·0	54·4	49·77	183 326	19·74 35·17 } 54·91
$Rh^{o''}$	$Rh^{o''}Rh^{o''}$ $Rh^{o''}rh$	28	12·44	28	0	16	12·8	44	12·57	13·7	14·43	113	12·19
$Rh^{o'}Rh^{o''}$ ..	$Rh^{o'}Rh^{o''}$	37	16·44	37	0	21	16·8	58	16·57	15·0	12·19	126	13·59
Rh^{o}		0	0	0	0	2	1·6	2	0·57	2·4		23	2·48
Rh'	Rh'Rh' Rh'rh	2	0·88	0 1	1 0	1	0·8	3	0·86	1·0		0 6	0 0·65 } 0·65
Rh"		1	0·44	1	0	1	0·8	2	0·57	0·2		12 $Rh^{o}Rz^{a}1$	1·29 0·11
Rh-negative	rhrh	33	14·67	33	0	19	15·2	52	14·86	13·3	16·59	137	14·78
Totals and percentage ..		225	99·99	171 (76·0%)	54 (24·0%)	125	100·0	350	100·0	100·0			

[1] Tested by the slide technique with Rh antiserum from Dr. G. L. Taylor.
[2] Tested by the tube technique with Rh antiserum from Dr. A. S. Wiener.
[3] Wiener *et alii* (1945).
[4] Race *et alii* (1944).
[5] Race (1945, in preparation; personal communication).

Work recently performed here indicates that Rh^{o}-blocking antibody can be removed in part or completely from human serum by absorption with defibrinated, washed sheep, horse or other animal red cells. This work is continuing and will be the subject of a later report. It is recognized that a knowledge of Rh-blocking antibody is equally as important as a knowledge of the Rh-agglutinating antibody.

Summary.

1. Tests for the Rh sub-types have been performed on the blood of 350 white Australians, by either slide or tube technique. The percentages were: Rh-negative, 14·86; $Rh^{o'}$, 54·0; $Rh^{o''}$, 12·57; $Rh^{o'}Rh^{o''}$, 16·57; Rh^{o}, 0·57; Rh', 0·86; and Rh", 0·57. The results obtained are compared with similar surveys reported in England and America.

2. Rh tests performed in Melbourne on 10,000 random samples of blood from Red Cross donors, anti-Rh^{o} and anti-Rh^{o},Rh' serum being used, have shown that 16·4% approximately of the blood tested was Rh-negative.

3. An attempt has been made to detail the complex pattern of the Rh antigens and their corresponding antibodies. Three of the suggested nomenclatures for the Rh sub-types are quoted.

4. Work is in progress to obtain more information concerning the Rh^{o} "blocking" antibody. Preliminary tests indicate that this antibody can be absorbed from human serum by the use of defibrinated, washed sheep or horse red cells, without effect on the agglutinating antibodies.

Acknowledgements.

We are grateful to Dr. A. S. Wiener, New York, and Dr. G. L. Taylor, England, for their kindness in providing us with small samples of anti-Rh typing serum; also to Dr. Margaret Karoly, Melbourne, and Miss D. Nicholas, B.Sc., Perth, for their cooperation in this survey.

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THE ADMINISTRATION OF PENICILLIN.[1]

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IT was the writer's good fortune when abroad recently to see something of clinical practices with penicillin, and from these experiences the following notes have been written. In both the United States of America and Great Britain there is now a trend to supplant sulphonamides with penicillin whenever supplies of the latter are available. Another change is that the size of the dose, the volume of injection fluid and the interval between doses are all being varied freely with the needs of the case, and there is no longer strict adherence to the standard three-hourly intramuscular dose of 15,000 units dissolved in three millilitres of saline solution.

One of the great difficulties in the administration of penicillin is the strain imposed on both patient and staff by three-hourly injections. One solution of this difficulty, which has been notably successful in Great Britain, is the constant intramuscular drip method. Another solution is the administration of larger doses at less frequent intervals. Still further modifications towards the same end are Romansky's peanut-oil and beeswax suspension of penicillin, from which the drug is slowly absorbed after intramuscular injection, and McDermott and Tillet's[(1)] introduction of intermittent periods of treatment and rest. The last-mentioned workers believe that bacteria do not need to be bathed in penicillin continuously throughout treatment. They have experimentally shown that bacteria, when once exposed to the antibiotic, do not begin to multiply again in the body for a period ranging from twelve to thirty-six hours. Tillet believes that the results of treatment in more than 100 cases of lobar pneumonia by this method were as good as those obtained by the standard method of treatment with no period of rest.

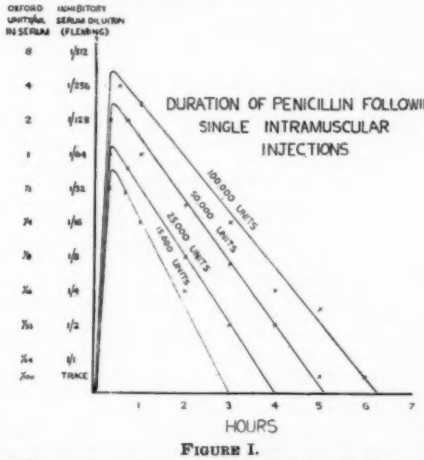

FIGURE I.

Penicillin tends to be retained longer by the body as the size of the individual dose is increased. Note the "fan" appearance of the above curves when the excretion portions are considered. Almost twice the time required for a 15,000 unit dose to become excreted from the 1/16 unit per millilitre level is taken by a 100,000 unit dose before it can no longer be detected in the blood.

Methods of Administration.

Since McDermott and Tillet's theory is not yet widely known or even accepted, methods generally aim at maintaining a detectable blood concentration of penicillin continuously for the maximum period.

[1] The substance of a lecture delivered at the request of the New South Wales Post-Graduate Committee in Medicine.

Intermittent Intramuscular Injection.

The standard three-hourly intramuscular dose of 15,000 units achieves a detectable blood concentration, except for an interval of some thirty minutes between doses. These periods of thirty minutes add up to about four hours a day. Reference to Figure II shows that six four-hourly intramuscular injections of 25,000 units achieve much the same result as eight injections of 15,000 units, although 150,000 units of penicillin are used instead of 120,000 units.

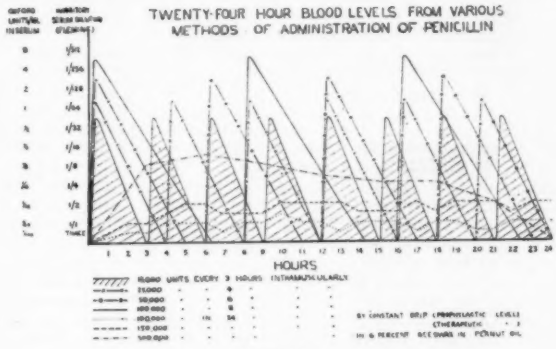

FIGURE II.

These blood-level curves are typical of those found when the Fleming micro test (see *The Lancet*, November 11, 1944) is used for estimation of the amount of penicillin in body fluids. They show the kind of blood cover obtained by the various methods of parenteral administration indicated, including the mixed regimens of Table I. The fluctuating levels established by the constant drip method are characteristic of this method, but do not seem important clinically.

Figure II also shows the blood concentration following five daily doses of 50,000 units and three daily doses of 100,000 units. These two dosage schedules are considered satisfactory, although they are more expensive in penicillin. Single large doses at the latter rate were used with great success by the Royal Army Medical Corps during the evacuation of wounded from Normandy, when periods of eight to twelve hours without further penicillin were inevitable. Unpublished work by Fleming shows that wound fluids retain penicillin from such a dose for some hours after it has been eliminated from the blood. Five-hourly doses of 50,000 units were used with excellent results in forward area evacuations in France and Belgium. Since penicillin is more readily available nowadays and is much cheaper than before, the objection to the use of these larger quantities is not serious. Also penicillin is now about three to five times as pure as it was eighteen months ago, and this fact has lessened the risk of reactions from larger doses.

Although the standard method of administration is eight three-hourly injections of 15,000 units, many workers have increased the dose to 20,000 units every three hours, believing that there is less likelihood of an odd failure to respond when the larger quantity is used. Others have given four doses of 25,000 units at intervals of four hours followed by a fifth dose of 100,000 units at the sixteenth hour each day, and others again have given three doses of 50,000 units at intervals of five hours followed by 100,000 units at the fifteenth hour. The two last-mentioned methods give the patient a longer rest and are held to be satisfactory.

The standard schedule and the various modifications in use are summarized in Table I. As will be seen later, these methods are further modified in the treatment of certain infections; for example, higher dosage (40,000 units every three hours) is employed in the treatment of subacute bacterial endocarditis.

Pain.—A problem of great importance is that of pain following intramuscular injection. Three things seem responsible here apart from the purity of the penicillin—the volume of the dose, the temperature of the liquid and the rate of administration. Penicillin may be dissolved in any desired quantity of saline solution or distilled water.

TABLE I.
Intramuscular Doses.

Dose. (Units.)	Interval in Hours.	Number of Injections per Day.	Daily Amount of Penicillin. (Units.)	Remarks.
15,000	3	8	120,000	Standard method.
20,000	3	8	160,000	Standard method with higher dosage.
25,000	4	6	150,000	
50,000	5	5	250,000	
100,000	8	3	300,000	
25,000	4	4	200,000	Permits eight hours' rest for patient.
100,000	(16th hour)	1		
50,000	5	3	250,000	Permits nine hours' rest for patient.
100,000	(15th hour)	1		

(It is practicable to make a solution containing 500,000 units per millilitre, if this is wanted.) A useful and necessary rule is to use as little fluid as possible consistent with economy in the handling of the penicillin. One dose of 15,000 units is readily given in one millilitre, instead of the customary three millilitres; 25,000 units may also be given in one millilitre, and 100,000 units are satisfactorily dealt with in three to five millilitres. These doses should always be warmed approximately to body temperature before injection, as present-day penicillin is stable enough to permit this. Much pain is avoided by the use of sharp needles of the finest gauge (25 or 26 gauge, one to one and a half inches long). Very slow introduction of the fluid is the final essential.

The Constant Intramuscular Drip Method.

When the constant intramuscular drip method is employed, the standard dose is 150,000 units per day for the treatment of a severe infection and 100,000 units per day for less serious infections and for prophylaxis. Both treatment and prophylactic methods should be started with an intramuscular dose of 25,000 units to provide an initial concentration; otherwise from four to six hours elapse before any penicillin appears in the blood. Reference to Figure II shows that the administration of 150,000 units per day by the drip method results in a low but constant blood level.

In Australia the "Soluvac" apparatus is widely used for the giving of fluids by the drip method, and it can be readily adapted for the administration of penicillin solutions. The daily quantity of penicillin is dissolved in one pint of sterile normal saline solution in the flask. A piece of paper is pasted on the outside of the flask, calibrated and marked to indicate periods of two hours and so facilitate the regulation of the drip rate. Good rubber tubing is essential to avoid destruction of penicillin, and it is always wise to test this before using a new variety.[1] The needle commonly used is of 18 or 20 gauge and two inches long. It is inserted usually into the quadriceps or pectoral muscles in such a way that the patient's movement will disturb the needle as little as possible. Provided that the needle is secured against movement by good taping over small pillows or rubber pads, little trouble is experienced from pain, œdema or loose needles.

The main problem is that of preventing irritation of muscle tissue by the needle tip; hence it is important to fasten the needle with complete freedom from side tension, since this inevitably leads to painful œdema. Track infection is avoided by changing of needle sites to the other side of the body every twenty-four or forty-eight hours, and the drip bottle unit with rubber tube to the needle is replaced every twenty-four hours.

Constant Versus Intermittent Therapy.

Some comment may be made here on the indications for the administration of penicillin by the constant drip method or by the intermittent injection method. From Garrod's work[(2)] on the action of penicillin, it would appear that only minute traces of penicillin are necessary to inhibit the growth of susceptible organisms. Penicillin, however, must come in contact with the organism, and this will occur more readily in those tissues which are freely supplied with blood—for example, congested areas, areas of cellulitis *et cetera*. In the cavity type of infection (meningitis, empyema, osteomyelitis and infection in wound sites) adequate penicillin is less likely to reach the organism. Selbie[(3)] has found that the higher blood concentration peaks of large intermittent doses are more likely to penetrate infected cavities than continuous low blood levels. The indication then is to use the continuous drip method with its low constant penicillin blood level for the lesions with the good blood supply and the intermittent injection method for the cavity type of infection. There are also differences in the diffusion values for intermittent doses of various sizes. It is most unlikely that penicillin will be found in the cerebro-spinal fluid after the intramuscular injection of 15,000 units, but definite amounts may be found after a single injection of 100,000 units. (At present, it is not certain whether this fact is sufficient to obviate intrathecal administration in meningitis.)

Peanut Oil, Beeswax and Penicillin.

Romansky has developed a peanut oil and beeswax preparation. An intramuscular injection of 300,000 units of penicillin suspended in one millilitre of 6% solution of beeswax in peanut oil will maintain a detectable blood level for 24 hours. Similarly the injection of 150,000 units suspended in a 4% solution of beeswax in peanut oil results in a detectable blood level for sixteen hours, and the injection of 100,000 units in a 3% solution of beeswax in peanut oil suffices for twelve hours. These mixtures are thick, especially the one in which a solution of beeswax is used, and require some skill in administration. The objection to the introduction of a somewhat insoluble wax into the tissues is countered by the statement that the wax disappears in less than a month.

Oral Administration.

Obviously oral administration would be the most convenient method, but no one has solved the problem of protecting most of the penicillin from destruction in the stomach or bowel before it is absorbed. Briefly, the present position is that to obtain a given blood concentration, five to six times more penicillin must be given orally than by intramuscular injection. Consequently it does not appear that oral administration will be practical until penicillin is available here in much greater quantity and at lower cost. It may be mentioned that McDermott has treated successfully 20 patients suffering from pneumonia with five 100,000 unit doses given orally every three hours followed by a twelve-hour rest period in a course lasting five days.

Sensitivity of Organisms to Penicillin.

It is well known that certain organisms are sensitive to penicillin and that others are not. Some species of organisms are uniformly sensitive to penicillin—for example, the pneumococcus, the gonococcus and *Streptococcus pyogenes*. In other species a small percentage of strains are partly sensitive—for example, *Staphylococcus pyogenes* and most strains of *Streptococcus viridans*. It is unlikely in infections due to these relatively insensitive strains that the usual parenteral treatment will result in a blood level of penicillin high enough to affect the organisms; but this usually is possible with local treatment. It is generally considered, however, that parenteral treatment should be tried when local treatment is inapplicable, even when it is found that the organism is relatively insensitive. The higher dose rates recommended for subacute bacterial endocarditis can be used in these cases.

Duration of Treatment.

As with the sulphonamides, penicillin treatment should be continued after the apparent cure of the patient. For example, the temperature of a patient with pneumonia may fall to normal after forty-eight hours' treatment; but treatment should continue for a further two or three days to ensure against relapse. Again, the blood of a patient suffering from subacute bacterial endocarditis may fail to yield a growth of microorganisms after the first ten days

[1] "Latex" or gum rubber tubing commonly used in transfusions is satisfactory.

of the course; but penicillin treatment is continued for a further ten or eleven days to complete sterilization of the valve lesion, when this is possible.

Treatment Schedules.

It is now generally the practice abroad to use penicillin as the primary treatment in all infections caused by penicillin-sensitive organisms. No longer is it the practice to begin the treatment with sulphonamides and to use penicillin only when the patient fails to respond, because it is held that penicillin is in general more effective than the sulphonamides and should be used as the chemotherapeutic agent of choice. This preference for the primary use of penicillin has extended to fields in which the sulphonamides have up to now held pride of place—notably pneumococcal pneumonia.

For convenience a few dose-rate schedules are given which can be taken as accepted treatments overseas for specific infections.

General Treatment.

In pneumonia (pneumococcal and streptococcal) 15,000 units to 20,000 units are given intramuscularly every three hours, or 100,000 to 150,000 units are given daily by the constant drip method.

In meningitis (meningococcal, staphylococcal and pneumococcal) the same parenteral treatment is given as for pneumonia, with 20,000 to 25,000 units in five millilitres of saline solution or distilled water intrathecally once a day, two doses being given when the response is not good. Early failure to respond to intrathecal doses is followed by intraventricular or intracisternal puncture, the same local dose of penicillin being administered.

In general streptococcal or staphylococcal infections, 150,000 units are given per day by the constant drip method or eight three-hourly doses of 15,000 to 20,000 units or their equivalent are given as suggested earlier.

In subacute bacterial endocarditis the administration of 320,000 units per day for twenty-one days by doses of 40,000 units every three hours each has produced some 50% of cures on first treatment of *Streptococcus viridans* infections. In almost half of the remaining 50% a cure is effected by a similar course of twenty-eight days' duration, or even by a third course. In unsuccessful cases the lesion is usually found to have been successfully treated by such a series of doses from a bacterial viewpoint and death usually intervenes owing to mechanical failures such as embolism and hæmorrhage. Results are less favourable if the staphylococcus is the causal organism, but treatment should be attempted. The use of heparin with penicillin is not encouraged now, since it has led in a few instances to excessive loosening of vegetations and subsequent fatal embolism.

In chronic osteomyelitis, 20,000 units every three hours are commonly employed and will control the exacerbation of old chronic lesions in the absence of large sequestra. If surgical treatment is necessary, the patient may be given 160,000 units by the constant drip method, and penicillin may be administered locally, either in the form of penicillin-sulphanilamide powder or in a solution containing 1,000 units per millilitre, at the time of operation or whilst the lesion is kept open. Tubes placed in the wound prior to closure for the introduction of penicillin into the cavity are no longer in wide use, as they have led to secondary infections. In the prophylaxis of compound fractures reliance is placed on a parenteral dose of 100,000 units a day, either intermittently or by the constant drip method. In such cases penicillin-sulphanilamide powder is dusted onto the wound surface before closure. However, it must be admitted that penicillin therapy has not been by any means uniformly successful in controlling chronic osteomyelitis following trauma, and much work remains to be done.

In gonorrhœa, from 120,000 units to 180,000 units are given, in doses of 15,000 units every three hours; higher efficiency is obtained with the larger doses. Romansky's peanut oil and beeswax mixture containing 100,000 units per millilitre is effective in two or three doses of one millilitre, twelve hours apart. As the patients may also have a coincidental treponema infection, their serum should be tested for evidence of syphilitic infection at intervals of three and six months after any penicillin treatment. There is a delay in the appearance of antibodies revealed by the Wassermann testing due to the short course of penicillin treatment for gonorrhœa.

In syphilis, the large-scale American work has revealed that 3,600,000 units given in doses of 30,000 units every three hours for fifteen days have the highest efficiency against primary syphilis (about 90% freedom from relapse); 2,400,000 units given over a period of seven and a half days will produce about an 80% result. Congenital syphilis in the newborn responds well to small doses (2,500 units every three hours for seven days). In all cases it should be remembered that Wassermann or Kahn tests may continue to produce reactions for two or three months after successful treatment. In the 10% to 20% of failures to respond to these doses of penicillin, it is almost invariable for the reappearance of antibodies to be noticed between the 180th and 230th days from the end of treatment. This period may therefore be taken as the critical time during which relapses may occur, although freedom from signs of persisting infection after the 270th day is now regarded as a satisfactory criterion of cure. Wassermann or Kahn serum tests are carried out usually at intervals of two, four, six, nine, twelve, eighteen and twenty-four months from the last penicillin treatment, cerebro-spinal fluid examinations being made at six months and eighteen months. As in subacute bacterial endocarditis, it is noteworthy that patients who have relapsed respond to further repeat courses of penicillin, in the same way as do those successfully treated on the first occasion. This means that if 20% of syphilitics fail to remain cured after one course of penicillin treatment, then 80% of this 20% will respond satisfactorily to a second similar course, and so on. In other words, no increased resistance to penicillin is built up by previous unsatisfactory treatment.

Local Treatment.

In burns, penicillin-sulphanilamide powder is commonly dusted on burnt areas before the local dressing of "Vaseline" gauze is applied. Further applications of the powder are made each time the area is dressed. If the burn is severe, usually 150,000 units per day by the constant drip method, or intermittently, are given as a further prophylactic measure. Penicillin treatment here is of course additional only to the usual serum or plasma transfusions, but it has been successful as the sole anti-infective treatment in cases of severe burns.

In skin infections, sprays are most useful, since ointments do not retain their potency for long. Freshly prepared solutions of 500 or 1,000 units per millilitre in distilled water are sprayed over the areas three to six times a day from the usual pressure-bulb atomizer spray. Most staphylococcal and streptococcal infections respond readily to this treatment.

For the eyes, the usual solution in saline solution contains 1,000 units per millilitre, and is applied by dropper every two or four hours. Solutions are preferred to creams, because of cleanliness and absence of irritation common to the latter.

Among mouth infections, Vincent's angina, acute streptococcal tonsillitis and sore throat are treated by either tablets or pastilles containing 500 to 1,000 units each. The aim is to dissolve in the mouth one 500 unit tablet every thirty to forty minutes or one 1,000 unit tablet every sixty to ninety minutes. Tablets are made with inert, dry powder bases and are remarkably free from deterioration even at room temperature. Pastilles on the other hand have as a base 40% gelatin in water, and are not stable for more than a few days even in the refrigerator. Results have been most promising in all cases in which these amounts of penicillin have been used.

In severe boils, a useful treatment is the administration of 20,000 unit doses every three hours for seventy-two hours, although if the patient is ambulatory three intramuscular doses of 10,000 units on the first day, with two

similar doses twelve hours apart on the succeeding two days, may be a more practical treatment.

It has become common practice to give an intramuscular dose of 50,000 to 100,000 units of penicillin at the commencement of serious operations involving infected or dirty tissues. This allows them to be bathed freely in the antibiotic during surgical measures, and provides a satisfactory start for the subsequent prophylactic administration of penicillin.

Conclusion.

The doses and methods of administration suggested in this paper are for guidance only. They were the basis of current practice in the United States of America and in Great Britain at the time of the writer's visit. It is certain, however, that there will be many more changes before penicillin therapy becomes a comparatively stable procedure.

Acknowledgements.

Permission for the publication of this article has been granted by the Director-General of Medical Services, Australian Military Forces. Acknowledgement is made to Colonel E. V. Keogh, Director of Hygiene, Pathology and Entomology, Australian Military Forces, without whose assistance the material for these notes could not have been obtained. Valuable assistance in the preparation of the notes has also been given by Professor H. K. Ward, University of Sydney, and Major R. Walsh, Australian Army Medical Corps. An opportunity is also taken to acknowledge the following sources from which much of this information was derived: Royal Army Medical Corps officers, with units on the Continent and in the United Kingdom; Mr. Vaughan Hudson and Professor Selbie, of Middlesex Hospital, London; Professor Learmonth, of the University of Edinburgh; Lieutenant-Colonel Jeffries, of the Radcliffe Infirmary, Oxford; Professor Walsh McDermott, Cornell University, New York Hospital; Dr. Nelson, of Johns Hopkins Hospital, Baltimore, Maryland; and Dr. Anderson, of Evans Memorial Hospital, Boston, Massachusetts.

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A PRELIMINARY NOTE ON THE CULTIVATION IN VITRO OF NEW GUINEA STRAINS OF HUMAN MALARIAL PARASITES.

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INTEREST was first taken in the in-vitro cultivation of New Guinea strains of human malarial parasites when the writer was with an Australian casualty clearing station at Lae. There a number of cases of fever remained undiagnosed. It was thought that perhaps parasites were present, but in submicroscopic densities, and that cultural investigation might result in sufficient increase for them to be seen.

A control culture of *Plasmodium falciparum* was attempted by means of the method recommended by Knowles.(1) The parasites were seen to develop to early division of chromatin, but the investigation had to be abandoned owing to pressure of routine work.

At an Australian blood and serum preparation unit the attempt to cultivate parasites was resumed. In the city military hospitals blood was collected from patients suffering from malaria before treatment was begun. After eighteen attempts with both *Plasmodium vivax* and *Plasmodium falciparum*, various techniques being used, a culture was obtained. Schizogony, and then development of young trophozoites in other red cells, were seen in the twenty-eight hour old culture from a patient with numerous ring forms of *Plasmodium falciparum*. Then a change was seen in the behaviour of the parasite—it developed into forms which came to resemble gametocytes. This last phase began when the culture was seventy-eight hours old.

It was impossible to determine whether there was any early increase in the number of parasites owing to the technique of culture. Certainly, when the culture was five days old, parasites were scanty. Subculture into fresh compatible normal serum, red cells and glucose gave a result similar to that in the parent culture.

The method which gave these results has not yet been used for *Plasmodium vivax*.

Technique.

The technique used was derived from that described by Bass and Foster(2) in 1912. Since that date several techniques have been described by others with varying results. Trager,(3)(4) working with *Plasmodium lophuræ*, had success by suspending cells in a balanced salt solution containing glucose. He improved his earlier results when he added calcium pantothenate to the culture. He was able to obtain survival for ten to sixteen days, using infectivity for chickens as the criterion of survival of parasites.

The method finally evolved in this investigation is as follows:

> Twenty to thirty mils of blood are placed in a sterile defibrinating tube containing 0·1 ml of 50% glucose solution. The blood is stirred gently for five minutes with a glass rod. When defibrinated the blood is centrifuged. The serum is drawn off and placed in a sterile, flat-bottomed tube about half an inch in diameter, so that there is a column of one and a half to two inches of serum. Red cells from beneath the leucocyte layer are then placed at the bottom of this serum to form a layer about 1/20 inch thick. The tube is plugged with cotton wool and incubated aerobically at 37° C. The culture is sampled as required by the withdrawal of red cells with a Pasteur pipette.

Apparatus.

The defibrinating tube was a large test tube. The glass stirring rod was bent zig-zag fashion in its lower two inches and perforated the cotton wool plug in the end of the tube. Rotation of the rod for five minutes always secured defibrination and thorough mixing of the glucose. Defibrination is preferred to the addition of sodium citrate, as, in preparations containing the latter, platelets remain and cause unnecessary confusion. Pasteur pipettes with fine tips are desirable, and some practice is required to withdraw the right proportion of cells and serum for a satisfactory thin film when the culture is being sampled.

Discussion.

The method described is crude when the conditions in which the plasmodium lives in man are considered. It does, however, allow the parasite to develop, and possibly because of its limitations, stimulates the development of forms which are considered to be early gametocytes. Perhaps in man, too, gametocytes are formed as a result of conditions unfavourable for the schizogonous cycle.

The exact time taken for the complete schizogonous cycle to occur in culture could not be determined, as insufficient samples were taken. Moreover, it appeared that all parasites did not develop in parallel.

Thomson and Thomson(4) in 1913 confirmed the original culture work of Bass(2) in 1912 and gave details of technique and illustrations of morphological changes. Many attempts with varying success have been made since then. This note is written as the malarial parasites used were New Guinea strains.

Acknowledgement.

The Director-General of Medical Services, Major-General S. R. Burston, has given permission for the publication of this article.

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Reports of Cases.

BLAST EFFECTS COMPLICATING ABDOMINAL INJURIES.

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THE prognosis of an abdominal injury, whether subcutaneous or penetrating, is rendered graver when the injury is accompanied or complicated by blast effects.

When an abdomen is injured by blast, in the intestines hæmorrhagic areas are found, varying in size from punctate spots to large extravasations and hæmatomata. These may be subserous or submucous or may infiltrate the muscle coats. Similar extravasations of blood may be seen in the mesenteries, the retroperitoneal tissues and the solid viscera. Finally both the solid and the hollow viscera may be ruptured. The diaphragm may contain areas of hæmorrhage, or it may even be ruptured. In addition, blast injury of the abdomen is usually accompanied by blast effects in the lungs, which are more sensitive to blast than the abdominal viscera.(1) (This is so on land, whereas the opposite appears to be true in immersion blast, which is not discussed here.) Thus it may be seen that blast may inflict much more serious harm on the abdominal viscera than a penetrating wound.(2)

The above type of blast effect is due to a diffuse external force, such for instance as the explosion of an aerial bomb or a nearby hand grenade, as in the first two cases presented here. Case I is described to illustrate the clinical effect of grenade blast alone on the abdominal viscera. In Case II a penetrating abdominal wound due to a fragment of an exploding grenade was accompanied by a simultaneous blast effect on the abdominal viscera and right lung.

There is another type of blast effect complicating abdominal injuries. A sudden, severe, antero-posterior squeezing force exerted on the abdomen and back will cause local injury to the viscera. In addition, the sudden rise in intraabdominal pressure sends a diffuse wave of pressure against the diaphragm and overlying chest contents. Consequently the diaphragm and the bases of the lungs and the heart will suffer a blast effect from the pressure wave. This occurred in Case III, in which the patient was caught between two colliding truck buffers.

Case I: Grenade Abdominal Blast Injury Alone.

A grenade exploded a few feet in front of this soldier, aged twenty years. None of the fragments touched him, but the blast wave hit him on the abdomen, which felt as if it had been severely kicked. The pain was generalized all over the abdomen and made him feel nauseated. It was continuous and severe for twenty-four hours, when it slowly commenced to subside, so that when he was first examined forty-eight hours after his injury (evacuation difficulties caused this delay), it was a dull ache. During this time he passed urine twice, but the bowels were not opened. The urine was normal in appearance.

Examination then showed that the patient looked well. His temperature, pulse and respiration rates and blood pressure were normal. There was no bruising of the abdominal wall, which moved freely with respiration. Some generalized distension was detected in the abdomen. Generalized abdominal tenderness and slight muscular rigidity were present. No masses were palpable. Percussion revealed general resonance, and there was no evidence of free fluid. On auscultation some faint peristaltic movements were heard. A rectal examination and an examination of the urine revealed no abnormality. All other systems including the respiratory system were normal. An enema was given, with the resultant passage of flatus and formed fæces in which was neither frank nor occult blood. The patient's condition improved rapidly, the distension quickly subsiding and the tenderness disappearing in a further forty-eight hours. A week later he was well.

This patient was first examined in the recovering stages, when all his symptoms were decreasing in intensity. Consequently it was obvious that he was not suffering from peritonitis due to ruptured bowel, or from hæmorrhage due to a ruptured solid viscus. The disorder was certainly only that of subserous hæmorrhages of the viscera. Submucous hæmorrhages usually produce blood in the stool, intramuscular hæmorrhages cause more prolonged and severe distension, and retroperitoneal and large mesenteric hæmorrhages are accompanied by severe shock and vomiting. When the patient was examined forty-eight hours after injury, peristaltic movements were present. In such cases they may be absent soon after injury, even though the bowel is not ruptured. As the bowel recovers its tone, peristaltic movements reappear and the distension subsides.

Case II: Penetrating Abdominal Wound Accompanied by Abdominal and Lung Blast Effects.

A grenade exploded close to this soldier, aged twenty-five years. He was badly jolted by the blast, which struck him on the right side. At the same time he was hit by a small piece of grenade casing in the right anterior axillary line an inch above the costal margin. Abdominal pain was at first only slight, but it gradually became more severe, and he vomited an hour after injury. Twelve hours after he had been wounded, the pain was moderately severe, especially in the right hypochondriac and paraumbilical regions. The vomiting was not repeated, but he had a slight hæmoptysis just prior to observation.

Examination now disclosed that the patient was in remarkably good condition. The pulse rate was 110 per minute, the respiratory rate was 24 per minute, the temperature was 101° F., and the blood pressure was 100 millimetres of mercury, systolic, and 75 millimetres, diastolic. A tiny wound was found in the position described above. There was no bruising of the chest or abdominal wall. The abdomen moved little with respiration, and slight generalized distension was present. He was tender all over the abdomen, especially in the right hypochondrium. Slight generalized muscular rigidity was observed, again more accentuated in this region. The percussion note was resonant and there was no dulness in the flanks. There was no resonance over the liver area. Auscultation showed that peristaltic sounds were still present. A rectal examination and an investigation of the urine revealed no abnormality. The cardio-vascular system was normal. The left lung was normal, but at the base of the right lung the percussion note was impaired. The breath sounds here, though vesicular, were distant and were accompanied by numerous coarse crepitations.

Laparotomy was performed thirteen hours after receipt of the wound, under ether anæsthesia induced by the "open" method, a blood transfusion being given during operation. A right paramedian incision revealed much free blood and clots in the abdominal cavity. The small grenade fragment had perforated the liver from its anterior to its inferior surface, emerging just lateral to the gall-bladder. It had then perforated the great omentum and transverse mesocolon to enter the jejunum three feet from the duodenojejunal flexure. It had perforated one side only of the bowel, traversed the lumen and lodged in the opposite side of the bowel, whence it was easily removed through the perforation. This was closed by one layer of sutures.

In addition to the penetrating injury, there were extensive subserous areas of extravasated blood in both the small and large bowel, especially the ascending and transverse colon, which was grossly dilated. In the liver no other injury was found apart from the perforation, which was no longer bleeding. The rest of the abdominal viscera were normal, though the stomach was dilated.

Convalescence, aided by a Ryle's tube, a blood transfusion and saline infusions, was uneventful. Penicillin was given intramuscularly, 15,000 units every three hours for four days, a total amount of 480,000 units being injected. The abdomen remained distended for four days, when the bowels moved normally. The fæces were soft and contained no blood. The patient coughed up a little blood twice during the first week. The signs at the base of the right lung disclosed a patchy consolidation, which gradually cleared up, so that an X-ray examination, available fourteen days later, revealed only a

few blurred, slightly opaque areas in the lower lobe of the right lung. There was no fluid in the pleural cavity. These areas had disappeared a week later. The patient was discharged to a convalescent depot six weeks after operation.

Although this patient was suffering from abdominal and lung blast effects, a perforating wound of the liver and a perforation of the jejunum, his condition was so good that it was only the presence of the tiny entrance wound and the increasing abdominal pain that made one realize that the abdomen needed exploration. Even though the bowel was perforated, peristaltic movements were audible. This may be a diagnostic pitfall, for their presence is said to exclude bowel perforation;[1] yet, as has been pointed out by Estcourt *et alii*,[1] peristalsis may be active especially in cases of perforated colon. With regard to the presence of lung blast, Gordon-Taylor[2] states that this may be the only evidence of graver changes below the diaphragm.

Unfortunately no radiological facilities were available. An X-ray examination would have helped to locate the foreign body, though, as Reinberg[6] has pointed out, this may be most difficult in the abdomen.

Penicillin was used, as it is now in all abdominal injuries, because not only does it combat infection in the parietes, but also there is evidence to show that it may prevent peritonitis or lessen its dangers.[3]

Case III: Abdominal Crush Injury with Secondary Heart and Lung Blast.

A male patient, aged twenty years, was caught between the buffers of two colliding railway trucks, one striking him anteriorly in the central portion of the abdomen, the other posteriorly over the lumbar area of the spine. He immediately collapsed with severe abdominal pain and vomiting. When examined one hour later, he was complaining of severe generalized abdominal pain, most severe in the epigastrium. He had vomited twice, the vomitus containing no blood.

Examination showed the patient to be a slightly cyanosed young man, suffering severely from shock. He was breathless, the respirations, which numbered twenty per minute, being shallow and grunting in nature. The pulse rate was 130 per minute; the pulse was regular and thready. The blood pressure was 85 millimetres of mercury, systolic, and 55 millimetres, diastolic. The abdomen did not move with respiration, and it was slightly distended. Some abrasions and much bruising of the anterior abdominal wall were present, especially round the central portion. Generalized abdominal tenderness and board-like muscle rigidity, most marked in the epigastrium and right hypochondrium, were present. The percussion note was resonant and there was no dulness in the flanks. No resonance was detected over the liver area. Auscultation revealed a "silent abdomen". Examination of the back revealed bruising and tenderness over the lumbar part of the spine. A rectal examination and investigation of the urine revealed normal findings. The heart was normal in size, and appeared normal in every respect apart from the rapid rate. There was no evidence of pericardial effusion. The chest wall was normal. Examination of the lungs disclosed slight dulness to percussion at both bases. Here, the breath sounds, though normal in character, were distant and accompanied by coarse crepitations.

The patient was treated for shock by morphine and a transfusion of two litres of blood. Two hours later he was fit for operation, his pulse rate being 110 per minute. The pulse rhythm was regular. The systolic blood pressure was 100 millimetres of mercury and the diastolic pressure was 70. Abdominal exploration through a right paramedian incision was performed under ether anæsthesia induced by the "open" method. There was bruising of all layers of the abdominal wall. A small amount of blood was present in the abdominal cavity. Many irregular areas of extravasated blood and hæmatomata were present in the subserous tissues of the transverse colon, stomach and small bowel. A hæmatoma in the root of the mesentery had spread into the retroperitoneal tissues, and an extravasation of blood had occurred in the omentum. Subserous petechial hæmorrhages were seen in the liver, most pronounced over its superior surface. The gall-bladder, the spleen and the rest of the colon were normal. Three inches below the duodeno-jejunal flexure, the jejunum was completely torn across. End-to-end anastomosis of the jejunum was performed and the abdomen was closed without drainage.

In spite of Ryle's tube drainage and intravenous therapy with blood and saline solution, the patient never seemed to do well. His pulse rate remained between 100 and 120 per minute, and the blood pressure never rose above 100 millimetres of mercury, systolic, or 75 millimetres, diastolic. The day after operation, numerous irregular extrasystoles appeared, though apart from these no abnormality was detected in the heart. These extrasystoles continued until the patient's death, occurring at irregular intervals, sometimes singly, sometimes in showers. There was no vomiting or abdominal distension, and the bowels opened well on the fourth day. He passed a normal amount of urine, which was always free of blood, albumin and casts. On the fifth day he suddenly became cyanosed, his pulse was uncountable and he collapsed and died.

Post mortem, the abdominal findings at operation were confirmed. The anastomosis was healing well and the blood extravasations were becoming absorbed. When the large and small bowel was opened, submucous hæmorrhages were seen scattered throughout the small bowel and the transverse colon. The liver, in addition to its subserosal hæmorrhages, had a few areas of extravasated blood in its substance. The great vessels of the posterior abdominal wall were surrounded by clot, but were uninjured. There was no peritonitis.

The centre of interest lay in the thorax. The heart was flabby and dilated. It was the seat of numerous petechial hæmorrhages, subpericardial, intramyocardial and subendocardial. They were most prominent on the inferior surface of the ventricles. There was a little blood-stained fluid in the pericardial cavity. The parietal and fibrous part of the pericardium was also the seat of hæmorrhages on the part nearest the diaphragm. In this, too, there were numerous petechial hæmorrhages, most pronounced round the central tendon.

In the lungs numerous irregular areas of extravasated blood were found scattered throughout the substance of the lower lobes. There was no fluid in the pleural cavities. The chest wall was not bruised, nor was any rib fractured.

Except for some bruising of the soft tissues of the lumbar region, the rest of the body was normal.

It is well recognized that blows over the precordium may lead to bruising and damage of the heart musculature, shown clinically by disturbances of rhythm and conduction, and by heart failure of varying degree. In this case the blow on the heart was caused by a different mechanism, though the clinical effect was the same. This mechanism was the sudden rise of intraabdominal pressure caused by the squeezing force of the buffers. This pressure wave, aided by the solid liver, which smacked up against the diaphragm, thus injuring its own superior surface as well, caused a blast effect on the diaphragm, lung bases and heart. The maximum effect on the heart was in the region of the inferior ventricular surfaces. Unfortunately, there were no electrocardiographic facilities for showing the origin of the extrasystoles.

The mechanisms of the abdominal injuries in a case such as this have been described by Lees.[5] The high jejunal tear is due to a shearing force, whereby the comparatively immobile upper part of the jejunum is nipped between the anterior buffer and the vertebral column. The extravasations of blood in the omentum and small bowel are due to the crushing antero-posterior force. In these cases, too, the great omentum may be torn away from the mobile transverse colon.

Summary.

Three cases illustrating blast complications of abdominal injuries are described in detail.

Acknowledgement.

We wish to thank Major-General S. R. Burston, Director-General of Medical Services, Australian Military Forces, for permission to publish this paper.

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Reviews.

ANATOMY.

PROFESSOR GRANT'S attractive book on anatomy has reached its third edition,[1] representing the eighth printing. It thus fully justifies the favourable opinion we have expressed in previous reviews. The main changes are some revision of the text, the addition of a number of illustrations and improvement of some old ones. It is inevitable that the author of a popular work such as this should strive continually to introduce improvements. One of the less fortunate results is the increasing bulk of the tome which has expanded from 650 to 821 pages. There is increasing attention to the dissecting room, and the text now contains scattered directions to dissectors. It is a pity that when rewriting the book the author did not eliminate some errors which have been perpetuated from the beginning; for example, the misleadingly simplified description of the development of the inferior *vena cava* and controversial views on the evolution of the teeth. The new illustrations maintain the high standard of clarity for which the book is notable. The views of Morton (acknowledged) on the foot and of Wood Jones (unacknowledged) on the anterior superior dental nerve are figured; it is pleasing to be able to note that the source of some of the illustrations is now being indicated. The figures of the distribution of the brachial and lumbo-sacral plexuses would have gained in value, had the author indicated their segmental significance. There can be little doubt that Grant is a master of human topographical anatomy, and is unsurpassed as a teacher of the subject; his embryology, unfortunately, is rather warped, while the ventures into comparative anatomy and anthropology are not always happy. We have no doubt that this book will maintain its popularity.

MASS RADIOGRAPHY OF THE CHEST.

DR. HILLABOE, chief medical director of the Tuberculosis Control Division of the United States Public Health Service, and Dr. Morgan, medical officer in charge of the radiological section of that division, are the joint authors of a handbook on mass radiography of the chest.[2]

The views of these authorities are of great interest to all who are working in the field of tuberculosis control, and to all who are using or intending to use the photofluorographic technique. The basic requirements for tuberculosis control are considered to be case-finding, treatment, rehabilitation, and protection of the sufferers from economic distress. With regard to case-finding methods, the authors consider that skin testing with tuberculin is best confined to the investigation of contacts of known sufferers from tuberculosis. Case-finding by mass radiography is most appropriate to the investigation of large population groups. From 1941 to 1944 twenty million photofluorograms were taken in the United States of America. Over a million industrial workers were examined between 1942 and 1944 by eight transportable field units. In this group of adults 1·5% had X-ray evidence of reinfection type tuberculosis, of which 65% were minimal, 30% moderately advanced, and 5% far advanced.

Planning of mass surveys should utilize every official and voluntary agency as fully as possible. A concise description is given of radiological equipment available at present, including the new photoelectric timing mechanisms. A chapter devoted to the physical factors affecting the choice of equipment is of particular interest. This quantitative study of the factors underlying radiographic detail is based largely upon data obtained in original investigations by Dr. Morgan. The authors deduce that "overall effective unsharpness is simply equal to the largest of the several types of unsharpness which may be present", overall unsharpness not being the sum of the individual unsharpness, as has been believed.

The conclusion follows that: "For photofluorographic films, inherent unsharpness exceeds target unsharpness when the target width is less than 2·6 mm. in the case of 4 × 5 films, 3·2 mm. in 70 mm. films, and 5·2 mm. in 35 mm. films if the target screen distance is 100 cm."

Taking into consideration the results of kymographic records of the time relations of heart movement together with other data, the authors express the opinion that valve-rectified and low-powered self-rectified transformers are almost equally suitable for mass radiography.

These conclusions are so contrary to general opinion that they constitute a strong challenge to other workers to confirm or amend them. The authors qualify their calculations regarding the relative efficiency of various techniques by stating emphatically that relative effective ability to record detail does not indicate relative diagnostic efficiency. Chapters on technique and diagnosis are supported by a number of excellent reproductions of radiological films. Examples of record and filing systems used in conducting mass surveys are described. Looking into the future, the authors forecast not only great improvement in photofluorographic technique, but also the perfection of means for producing strongly amplified fluoroscopic images for use in case-finding surveys. The book is well produced and is a valuable and stimulating contribution to the literature on the subject.

MEDICAL TREATMENT.

"THE ELEMENTS OF MEDICAL TREATMENT", by Sir Robert Hutchison, consulting physician, London Hospital and Hospital for Sick Children, Great Ormond Street, is a book to which many will need no introduction, as it has been a popular textbook amongst doctors and students since 1926.[1] Certainly the author needs none.

The fourth edition has been brought up to date and includes notes on penicillin and the later sulphonamides. These contrast quaintly with much of the subject matter, for the author appears to have much greater faith in certain medicines than is usual amongst the profession today, and one feels that some of the older therapeutic measures applied when the book was first written in 1926 should have been scrapped when the book was brought up to date. In this category are many drugs now believed to be therapeutically valueless and such outmoded measures as cupping and the use of leeches. Excellent sections on endocrines, diabetes, dyspepsia and kidney disease more than compensate for this. One is pleased to note the debunking of the "red and white meats" theory which is a form of diet quackery still far too widely practised on sufferers from kidney disease.

Two notable omissions from the book are the use of phenobarbital in hypertension and of aluminium hydroxide in treatment of peptic ulcer.

One of the last chapters, that on psychotherapy, is outstanding. It is a brief, concise and simple explanation of the psychoneuroses, the recognition and treatment of which is so important a part of modern medical practice.

THE DIFFERENTIAL DIAGNOSIS OF MAIN SYMPTOMS.

THE recent edition of French's "Index of Differential Diagnosis of Main Symptoms", the first published since 1938, will be welcome reading to many busy practitioners as well as to students.[2] The original author still plays a major role in its production, although he states that he has been ably assisted by A. H. Douthwaite. He suggests that he soon will be handing over to a younger generation who should keep pace with all modern changes.

The new edition, produced under the many difficulties of wartime conditions in England, has been brought fairly well up to date, although a number of the older illustrations are still produced.

The section on blood disorders is particularly helpful and the numerous coloured plates leave nothing to be desired. Pain in the chest is well discussed, and in the section con-

[1] "A Method of Anatomy: Descriptive and Deductive", by J. C. Boileau Grant, M.C., M.B., Ch.B., F.R.C.S. (Edin.); Third Edition; 1944. Baltimore: The Williams and Wilkins Company. Sydney: Angus and Robertson, Limited. 10" × 7", pp. 846, with many illustrations. Price: 48s.

[2] "Mass Radiography of the Chest", by Herman E. Hilleboe, M.D., and Russell H. Morgan, M.D.; 1945. Chicago: The Year Book Publishers Incorporated. 7" × 4¾", pp. 288, with many illustrations. Price: $3.50, post paid.

[1] "The Elements of Medical Treatment", by Sir Robert Hutchison, Bart., M.D., D.Sc., LL.D., F.R.C.P.; Fourth Edition; 1945. Bristol: John Wright and Sons Limited. 7¼" × 4¾", pp. 224. Price: 10s. 6d. net.

[2] "An Index of Differential Diagnosis of Main Symptoms", by various writers, edited by Herbert French, C.V.O., C.B.E., M.A., M.D. (Oxon.), F.R.C.P., assisted by Arthur H. Douthwaite, M.D., F.R.C.P.; Sixth Edition; 1945. Bristol: John Wright and Sons Limited. 10" × 6¼", pp. 1136, with 798 illustrations, 98 in colour. Price: 84s.

cerning *angina pectoris* the following passage is important in relation to this: "Even with the utmost care mistakes will be made, and on the whole it is better to reassure the patient and thus to risk an occasional loss of professional prestige, than to put one's own reputation first and frighten patients into needless invalidism."

A few points may bear criticism, especially where four or more illustrations are devoted to such rare diseases as Charcot's joints and Addison's disease. This feature tends to over-emphasize the frequency of these diseases.

Pain in the right iliac fossa is discussed in a rather sketchy manner, and leaves one with the impression that the majority of the causes of this condition are serious pathological lesions. Only too frequently the patient is seen who has had the appendix or ovary removed and adhesions separated without any relief of the pain.

The concise tabulation of the many causes of hæmatemesis, hæmoptysis, hæmaturia *et cetera* is helpful both from the clinical angle and from the examination point of view.

The price of the book is not high when one considers the many illustrations and the cost of smaller and less valuable publications. There is no doubt that in spite of wartime difficulties the standard of this work has been maintained. This edition appears to be in the nature of a farewell to the original author, who has initiated a very useful book of general information and has earned the gratitude of many.

BRONCHIAL ASTHMA.

A NUMBER of large textbooks on asthma and allied diseases have been published in the United States of America during the past decade and some must wonder whether so many books on one subject are necessary. However, though each contains most of the essential facts, the best emphasize the author's personal viewpoint on controversial aspects. "Bronchial Asthma", by Leon Unger, is of this type, and it gives an excellent survey of the subject interpreted by one who has evidently had extensive experience with this disorder.[1] Like most American physicians, Unger evidently considers allergy to be the major causative factor; and some will consider that too little emphasis has been laid on those cases (for example, many of those with extensive sinus disease) in which no significant allergic phenomena can be demonstrated. The constitutional factor is discussed only very briefly and the term diathesis does not appear in the index. Another minor criticism is that the author sometimes uses the term "allergic" as if it meant "suffering from one of the so-called allergic diseases", and he actually describes as "potentially allergic" individuals in whom skin tests demonstrated marked hypersensitivity.

But the style generally is clear, interesting and easy to assimilate and definite opinions are expressed on controversial aspects such as the significance of psychological stress and of allergy to foods.

It is pointed out that extracts of some allergens are of poor quality and that caution must be exercised in interpreting the results of skin tests, especially with food extracts. Chapters of especial interest are those on the history and treatment of asthma. The illustrations and type are clear, the format is good and the bibliography extensive. This volume will be of great use not only to students and practitioners, but also to those specially interested in this subject.

THE PHYSICAL ASPECTS OF RADIUM THERAPY.

THE modern methods of using γ ray sources in treatment require an appreciable knowledge of the underlying physical and mathematical principles. In his "Radium Therapy: Its Physical Aspects", Dr. C. W. Wilson, by assembling much necessary data otherwise available only in isolated papers, has produced a valuable book of reference.[2]

The author, who is physicist to the radiotherapy department of the Westminster Hospital, has catered not only for the medical man commencing radiotherapy, but also for the physicist taking up radiological work. As a result, the statement of physical principles is everywhere correlated with the use made of them in practical radiotherapy.

Commencing with an adequate treatment of the general properties of radioactivity, the book deals successively with absorption and scattering of γ rays, and with the methods of measuring γ ray dosages. The rationalized methods of distribution of sources (both interstitial and superficial) are then treated fully and illustrated with numerous clinical examples. Unfortunately, these examples are almost entirely taken from the published papers available in reference libraries. Additional examples selected from the author's own hospital experience would have been of considerable value. All workers in this field know just how frequently it becomes difficult for anatomical and other reasons to apply generalized rules in certain individual cases. As many illustrations as possible of allowable compromises which have given satisfactory clinical results are therefore always welcomed.

The concluding section sets out the methods used to protect personnel of radiotherapy departments from over-exposure to radiation. Tables and mathematical formulæ used frequently in calculation of dosage problems are given in appendices.

The book throughout is plentifully illustrated with diagrams and plates. Reference is made to essentially all the important papers which have appeared in the literature within the last fifteen years and the contents are carefully indexed. The general production is good, particularly as war-time economy standards have been observed.

The book is the most up to date of its kind and should find a place in the library of all using γ rays in therapy.

Notes on Books, Current Journals and New Appliances.

CONTROLLED PROJECTION.

"To understand the development of mental organization and the determinants of character, we need to know how people organize their ideas of themselves and the world they live in and the conceptions formed under normal and abnormal conditions. Projection pursuit is one way we can do this, and Controlled Projection provides a method suitable for genetic and comparative studies." Mr. John C. Raven, in his book "Controlled Projection (1944): A Standard Experimental Procedure", states that his intention in publishing the method is to present not a technique of testing for applied psychology, but a method of inquiry suitable for experimental work.[1] A test like the Rorschach ink-blot test employs meaningless material, and consequently gives information concerning the subject's instinctive tendencies to organize perception and to give significance to otherwise meaningless experience. The controlled perception test, on the other hand, employs meaningful material, and so gives more information concerning the subject's interests, preferences, motives and conative control of thought; moreover, the use of meaningful material adds psychological consistency to the data. Briefly, the method consists of asking the subject to draw, and while he is drawing, to imagine and describe a series of happenings. Full details of the test are given, and the test drawings and questions are provided. The book is well printed on good quality paper; but some irritating inaccuracies appear. For example, it is a pity to find the name "Rorschach" spelt incorrectly with a third "h", and a reference to an article in a French journal misspelt and with meagre details. Moreover, although for obvious reasons it is undesirable that the subject shall pay much attention to the English (correct or incorrect) in which he couches his answers to the test questions, we can imagine looks of horror on the faces of kindergarten experts who first see the English in which one or two of the test questions are framed. However, we have no wish to be unduly carping, and this test, designed primarily for normal children and adults, may prove to be of value in the future.

[1] "Bronchial Asthma", by Leon Unger, B.S., M.D., F.A.C.P.; Introduction by Morris Fishbein, M.D.; 1945. Illinois: Charles C. Thomas. 9¼" × 6", pp. 743, with many illustrations. Price: $9.00, post paid.

[2] "Radium Therapy: Its Physical Aspects", by C. W. Wilson, M.Sc., Ph.D., F.Inst.P.; 1945. London: Chapman and Hall Limited. 8¾" × 5½", pp. 235, with many illustrations. Price: 18s.

[1] "Controlled Projection: A Standard Experimental Procedure", arranged by John C. Raven, M.Sc.; 1944. London: H. K. Lewis and Company. 10¼" × 8¼", pp. 76, with many illustrations and three projection sketches. Price: 12s. 6d.

The Medical Journal of Australia

SATURDAY, DECEMBER 29, 1945.

All articles submitted for publication in this journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given without abbreviation: initials of author, surname of author, full title of article, name of journal, volume, full date (month, day and year), number of the first page of the article. If a reference is made to an abstract of a paper, the name of the original journal, together with that of the journal in which the abstract has appeared, should be given with full date in each instance.

Authors who are not accustomed to preparing drawings or photographic prints for reproduction are invited to seek the advice of the Editor.

THE DIGGER AND THE DIGGER SPIRIT.

THE men and women of the services who "have counted all things but loss" that they may serve the nation, and indeed through the nation humanity itself, are of the cream of society. They are our aristocracy, if we use the word in its original sense to mean the best people, and have earned this title by their self-sacrifice, their courage and their achievement. In a discussion last year on the needs of the service man and on the indebtedness of the community to him for deliverance from malignant and barbarous foes, we declared in the title of the article that "Only the Best is Good Enough". It was pointed out on that occasion that men of the services returning to civil life will not expect that a life of ease and comfort with spoon-feeding and no responsibility shall be provided. "They will look for an opportunity to compete among the active and self-supporting members of the community, for a chance to show that zest and audacity can win a place in peace as they won many an objective in war." Since these words were written hostilities have ceased, many of the service personnel have returned to civilian life, some thousands of prisoners of war have come home and the general run of people have begun to think of a world in which war will have no place—the work of reconstruction has begun. During our reconstruction, our "winning of the peace", the objective must be sought in such a way that resources are used to the best advantage. There must be no room for double dealing, for shibboleths, for humbug or for laziness. Our service men in their campaigning had no use for these things. The New Guinea campaign, graphically described by Colonel F. Kingsley Norris in a recent issue of the journal, could not have been brought to a successful conclusion, the words "Kokoda Trail" would not have become for all time the signature of determination, of fortitude, of endurance and of heroism, if the Australian diggers had been other than what they were. The obvious thing for the Australian people to do therefore is to inquire into the characteristic qualities of the Australian soldier. The opportunity to do this has recently been provided by Colonel A. Graham Butler, who has published a small but very worth-while volume,[1] "The Digger", which bears the sub-title: "A Study in Democracy".

Though it is to the qualities of the digger that we wish to devote special attention, it is necessary to follow Colonel Butler in his attempts to trace the origin and significance of the word "digger". The first two sections of the book deal with "The Diggers of the A.I.F." and "Diggers and Pioneers"; the third part is "The Digger and Democracy" and there is an epilogue "The Future of the Digger". As a matter of fact Colonel Butler's search for the origin of the word is introductory to the real reason for his inquiry. He finds that the history of the word digger seems to have a bearing on the history of the democratic idea and form of government, particularly as they have evolved in Australia. At the end of 1916 and during 1917 there occurred among the members of the Australian Imperial Force in France what Colonel Butler calls a social epidemic, characterized by "the universal and enthusiastic adoption" of the term digger by Australian soldiers in France and by "the general acceptance outside the force of the propriety of such appropriation". The acceptance of the name was subconscious; it was an instinctive reaction. Colonel Butler, continuing his medical metaphor, thinks that the "infection" or "suggestion" could have spread, as it did, only in a community already sensitized, as it were, to the psychological or sociological virus. In his opinion this sensitization was the result of three centuries of social conditioning. This is one of the reasons why he cannot accept Dr. C. E. W. Bean's view that the term digger originated in New Zealand, being applied to the gum-diggers of that country, and spread from them to all "Anzac" infantrymen. He points out also that Dr. Bean admits that the term had several independent origins. Another view sees a link between the diggers of the Australian Imperial Force and the gold-diggers of Australia of the 1850-1860 period. Further, it has been stated that the greeting "digger" was in use in Australia before the start of the 1914-1918 war. Colonel Butler traces a relationship between the pioneers of the army and the diggers. He finds that in the Kingsway Edition of Shakespeare the pioneer is defined as "a digger, a degraded common soldier". Samuel Johnson defined a pioneer as "one whose business it is to level the road . . . in military operations". The Oxford English Dictionary defines "pioneer" as "one of a body of foot soldiers who march with or in advance of the army, preparing the way for the main body"; secondary meanings are "one who digs a trench, a digger, excavator, miner". But for all his inquiry into the early history of diggers and pioneers (much has been left unmentioned) Colonel Butler has to admit that neither in the feudal nor in the industrial history of Britain did the social set-up favour association on man-to-man "diggerish" terms between the upper and lower social groups. With this observation he leaves his historical quest.

It will be convenient to consider the significance of the term "digger" as used by the Australian soldier together with Colonel Butler's remarks on the digger in relation to democracy. One of the elements in the make-up of the digger is his elevated loyalty, but he has to be differentiated from other soldiers and citizens. The term "digger"

[1] "The Digger: A Study in Democracy", by A. G. Butler, D.S.O., B.A., M.B., Ch.B. (Camb.), Col. (Ret.), A.A.M.C.; 1945. Sydney and London: Angus and Robertson Limited. 8¼" × 5¼", pp. 52, with illustrations. Price: 4s. 6d.

is identified, Colonel Butler states, with an outlook on social relations that is elemental and primitive, in tune with the stark and naked facts of life and death, of love and war, with the struggle for existence and with the creed that holds that

> The rank is but the guinea's stamp:
> The man's the gowd for a' that.

"The typical digger is not a man of rank; yet rank does not exclude, nor lack of rank *per se* confer, an inherent right to the title as a social hallmark." Colonel Butler delves into recent and past history to collect some names of persons who would qualify as "good diggers". He finally runs the digger to earth as "a man for whom freedom, comradeship, a wide tolerance and a strong sense of the innate worth of man, count for more than all the kingdoms of the world and the glory of them". He is bold enough, and he admits his boldness, to affirm that the digger is a product and possibly the most typical product of democracy.

On the question of democracy Colonel Butler quotes Benjamin Kidd, who showed in his book "Social Evolution" that in man organic evolution is being replaced by a social evolution, "motivated and directed by much the same biological and organic compulsions". This is the evolution on which stress has been laid by many persons in their discussions on matters medico-political. It has been operating for several centuries and is, as Colonel Butler well calls it, the *élan vital*, the creative urge, in the evolution of modern democracy. The transference of British people to the Australian continent brought a vigorous, hardy and adaptable migrant to a new environment where life became "attuned to rapid and dramatic social adjustments". This applies also to America. Colonel Butler points out that in these adjustments some social groups have won and others have lost. He finds the diggers and pioneers among the winners. At this point we must leave Colonel Butler, urging all who can come by his booklet to read it for themselves. In this short discussion some of the qualities of the digger have been mentioned and his spirit has been set forth. It is this spirit that must actuate the people of Australia if in their post-war reconstruction they are to fashion an edifice, substantial, durable and equal to the needs of the many and varying types of citizen who will make it his home. Of the attributes by which this spirit is generated, four that have been named—freedom, comradeship, a wide tolerance and a strong sense of the innate worth of man—are preeminent. Professor Walter Murdoch, an Australian whose name would be one of the first in any list of extra-service "dinkum diggers", has deprecated the adherence by Australia to any set "-ism" or "-ology" in the political sphere. He holds that Australia can and should create her own way of life and should eschew the set ways and methods of any other country or people. She will do this and will have no cause for regret if she will foster the true digger spirit, so nobly and freely displayed by her fighting men.

Current Comment.

THALASSÆMIA.

In 1925 T. B. Cooley, E. R. Witwer and P. Lee, in an article entitled "Anæmia in Children with Splenomegaly and Peculiar Changes in Bone", drew attention to a type of anæmia which has since that date been associated with Cooley's name.[1] This condition, which has a congenital origin, has been described as being characterized by a chronic, progressive, hypochromic and microcytic type of anæmia, peripheral erythroblastosis, an increased number of target and oval red blood cells, decreased fragility of erythrocytes, splenomegaly, deposition of pigment in the viscera and changes in the bones. Whitby and Britton state in their textbook that Cooley (and Lee) in 1932 expressed the opinion that the condition was a dyshæmopoiesis due to a metabolic fault which also affected bone formation. In the same year G. H. Whipple and W. L. Bradford discussed the condition as a "racial or familial" anæmia of children.[2] They described three cases which conformed to the group described by Cooley, and made three suggestions as a result of their study. In the first place the bone marrow changes, which were typical, suggested a process analogous to pernicious anæmia, and were thought possibly to depend on a lack of some unknown material. In the second place the bone changes were thought to be due in part to some fundamental metabolic disturbance of the order of the abnormalities of the bone in scurvy or acromegaly. In the third place pigment abnormalities were taken to indicate some fundamental change in the method of handling body pigment. They followed these suggestions with the statement that all these abnormalities might be thought of as related and due to some racial or inherited defect. It should be noted that the condition is confined almost entirely to Italians, Greeks and Syrians. For this reason Whipple and Bradford thought the name thalassæmia or Mediterranean anæmia would be suitable. (The Greek word θάλασσα means the sea, and was applied to the Mediterranean sea.) The name thalassæmia seems to have been adopted fairly widely, though available references show that this has been chiefly in America. The condition is grave; it occurs in children and is usually fatal. Whitby and Britton state that most patients fail to reach the age of ten years, and add that none of Cooley's patients have lived more than ten years. These patients have suffered from what may be called the full-blown genuine malady.

In 1940 an interesting paper was published by M. M. Wintrobe, E. Matthews, R. Pollack and B. M. Dobyns,[3] in which they described what they regarded as a benign form of thalassæmia. The patients were fourteen in number and were members of three Italian families, representing three generations in one family and two in another. In four instances poikilocytosis, microcytosis, hypochromia and stippling of the red cells as well as corpuscles resembling targets were seen. In addition there were increased resistance of the red cells to the hæmolytic action of hypotonic saline solution, splenomegaly and bilirubinæmia or urobilinuria. One of the patients had erythroblastosis in the sternal bone marrow and slight osteoporosis. In four instances all the abnormalities mentioned, except splenomegaly, were found. In two children slight splenic enlargement was present without significant changes in the blood. W. N. Valentine and J. V. Neel, in an important contribution in 1944,[4] describe the cases of Wintrobe and his co-workers as resembling thalassæmia in many respects, but as being quantitatively much less extreme. They also mention an apparently identical condition described by Dameshek and Strauss *et alii* as target-cell anæmia and familial microcytic anæmia. They add that the final link relating the milder condition to thalassæmia was provided by Wintrobe, who confirmed observations by Angelini and Caminopetros, that decreased fragility of erythrocytes might be observed in the parents of persons suffering from thalassæmia, and also showed that these parents had a blood picture that was identical with that of the milder anæmia. This type of blood picture has also been found in the blood of siblings of patients suffering from thalassæmia. Valentine and Neel discuss the genetics of thalassæmia. They put forward three possibilities and conclude that the

[1] *American Journal of Diseases of Children*, Volume XXXIV, 1927, page 347.
[2] *American Journal of Diseases of Children*, Volume XLIV, 1932, page 336.
[3] *The Journal of the American Medical Association*, Volume CXIV, 1940, page 1530.
[4] *Archives of Internal Medicine*, Volume LXXIV, 1944, page 185.

bulk of evidence favours the hypothesis that the mild state, which they term *thalassæmia minor*, is due to heterozygosity for a factor which, when homozygous, results in full-blown thalassæmia (*thalassæmia major*). From this they discuss a carrier state of the condition. They hold that certain persons may be regarded as carriers of the disease regardless of the ultimate genetic mechanism involved in its transmission. This, of course, opens up a wide range of discussion in the field of genetics. Apart from that, however, it calls for reference to the racial characters that have been ascribed to the condition. The two grades of the disorder, minor and major, are rare. Their occurrence has recently been estimated by Neel and Valentine, who studied hospital records in the city of Rochester in the State of New York.[1] They find that the incidence of *thalassæmia major* in the Italian element in Rochester is approximately one in 2,368 births; the incidence of the minor state is one case in 25 persons. This is a most interesting finding, and seems to offer scope for future investigation. Care must be used in any work on this subject in regard to the assumption of a racial origin. The need for this care has recently been emphasized by H. Marshall, a statistician at the Bureau of Statistics, Ottawa, Canada.[2] Marshall points out that descriptions of racial origin are to a large extent geographical. In the case of thalassæmia this seems to apply. Marshall refers to "ancestral origin", and this term might well be used in discussions on thalassæmia until some definite racial limitation was determined. More work on this subject is indicated, and Australians might find scope for research among the many Italians settled in North Queensland.

REAL VERSUS SUPPOSED DISTURBANCES OF THE ENDOCRINE GLANDS.

MANY physicians living today have had the opportunity of witnessing the rise of endocrinology from small beginnings to a position commanding a large and ever-growing literature. That enthusiasm has led to an uncritical attitude in diagnosis and treatment is the thesis of Edward H. Rynearson, who holds that endocrinology is not a science, but "a part, though a most intriguing part, of internal medicine".[3] When a success has been gained in the treatment of a glandular deficiency by administering the missing hormone there has always been a tendency to explain conditions presenting some similarity of feature on an endocrine basis. Dr. Rynearson utters a warning against the cocksure endocrine diagnosis of an abnormality for which another and simpler explanation can be found. "Because myxœdema is a clear-cut entity caused by the lack of a single hormone the administration of a small amount of thyroid extract completely controls the condition." The estimation of basal metabolic rate is an elegant procedure, giving a numerical assessment, but all patients with low basal metabolism are not sufferers from thyreoid deficiency; blood count, blood pressure and the gastric acid content may be low too; "dropped stomach", "dropped colon", "dropped kidneys" or a retroverted uterus may be present and the administration of thyreoid extract in such states would not be of the slightest benefit, to put it mildly. *Diabetes insipidus* is a consequence of under-action of the posterior lobe of the pituitary, yet many nervous water drinkers have been classified as suffering from endocrine disorders despite the fact that the differential diagnosis is comparatively easy. It is interesting to note, by the way, that this author strongly advocates the nasal insufflation of powdered whole posterior lobe for *diabetes insipidus*, two doses a day being apparently sufficient.

The boy who at school is nicknamed "Fatty" often develops into a big and healthy man and has nothing the matter with his pituitary; similarly girls over-tall for their years may require only philosophical adjustment to their height. Many a woman with undue adiposity and hairiness needs a prescribed scale of diet and exercise and a visit to a cosmetic specialist. The exhaustion of a tired business man keeping his affairs going with inadequate staff is often regarded as showing a male menopause. Dr. Rynearson suggests that if such a man had fewer forms to fill up he might easily regain physical vigour and sexual potency. Most mental defectives and most psychopathic and psychoneurotic persons have no endocrine dysfunction at all. That "American Indians do not raise beards" is given as a reminder that end-organ unresponsiveness does not necessarily arise from abnormal glands. Dr. Rynearson's final conclusion is well worth a special mention: "Obscure diseases usually are not made lucid by incriminating the endocrines." That endocrine therapeusis has had some triumphs none will dispute, but there is a tendency to stretch out the list. Experts in veterinary science often proclaim that there are more successes in their field than in that of human medicine, and possibly they are right.

THE CHOLESTEROL CONTENT OF FOODS

IN 1933 Twiss and Greene compiled a list of the results of quantitative analyses giving the cholesterol content of various foodstuffs.[1] These data have been used extensively and sometimes uncritically by other writers. Many of the determinations were old and carried out before cholesterol could be separated from other sterols; some were undoubtedly misleading through the use of inferior technique, and in regard to some there was no indication whether the figures represented percentages of the food as eaten or of the dry residue after laboratory dehydration. Again, the cholesterol content of animal organs varies with the amounts of this sterol in the diet; for example, the giving of egg yolk to a rat or guinea-pig can increase the liver cholesterol of the animal fortyfold. These considerations led Ruth Okey, of the Department of Home Economics and the Agricultural Experiment Station of Berkeley University, to conduct a laborious research on the cholesterol content of foodstuffs, using the most recent methods and avoiding former pitfalls.[2] Many of her figures are well below those which have hitherto been accepted as authoritative; ox heart, for example, which has long been regarded as a rich source of cholesterol, comes low in the list. Only two food substances, egg yolk and brain, have a percentage of cholesterol, reckoned on the basis of the undried material, of over 1%; most of the figures for these substances are about 2%. Liver and yeast come next with 0·6% to 0·7%, whilst the majority of foods lie between 0·1% and 0·2%. The author has not indicated why cholesterol should be singled out from all other sterols and be charged with special significance in human diet. It is true that Schoenheimer was convinced that animals absorb plant sterols with great difficulty or not at all, and the list of such is extensive, including the stigmasterol of soya bean, the several sitosterols, the zymosterol of yeast, the fucosterol of algæ and the cinchol of cinchona bark; but there are many animal sterols as well, such as the ostreasterol of shell fish, and dihydrocholesterol, which usually accompanies true cholesterol wherever this is found. Some readers, whilst accepting this author's figures, may query her ability to put forward conclusions concerning diet in pathological conditions. Her attitude is that in old age and where there is a tendency for cholesterol to be deposited in undue amounts or in wrong positions the intake of this sterol should be restricted, though she qualifies this pronouncement by stating that egg, which gives one-third of a gramme of cholesterol per yolk, should not be wholly excluded on account of its other and valuable ingredients.

[1] *The American Journal of the Medical Sciences*, May, 1945.
[2] *Canadian Journal of Public Health*, June, 1945.
[3] *The Medical Clinics of North America* (Mayo Clinic Number), Volume XXIX, July, 1945, page 1009.

[1] *The Journal of the American Medical Association*, Volume CI, 1933, page 1841.
[2] *Journal of the American Dietetic Association*, Volume CXXI, 1945, page 341.
[3] *Klinische Wochenschrift*, Volume XI, 1932, page 1793.

Abstracts from Medical Literature.

BACTERIOLOGY AND IMMUNOLOGY.

Viability of Typhus Rickettsiæ.

W. J. ELFORD AND M. VAN DEN ENDE (*The British Journal of Experimental Pathology*, December, 1944) began a programme of studies on the viability and filterability of typhus Rickettsiæ. Their first work was directed to determining conditions of suspending fluid, temperature and pH. It was found that serum broth was the most suitable medium for cultivation; the optimum pH range was from 6·0 to 8·5, while infectivity tests of material suspended in serum broth at pH 7·6, held at varying temperatures for varying times up to eight days, showed that at −77° C. the viability remained unchanged for the whole period, while at 37° C. the organisms survived for only forty-eight hours. Filtration experiments were performed with yolk sac fluids or emulsions of infected mouse lung, and it was found that gradocol membranes of 700mμ passed a filtrate still infective, while a 500mμ one produced a sterile filtrate, giving a definite indication that the organism is pleomorphic, and the smallest phase is less than 400mμ to 500mμ in diameter.

Examination of Urine for Mycobacterium Tuberculosis.

H. J. PEPPLER AND J. T. HILL (*The British Journal of Experimental Pathology*, December, 1944) discuss the routine examination of urine for *Mycobacterium tuberculosis*. They collected twenty-four hour samples in sterile one litre bottles which had been prepared with 1·5 millilitres of acriflavine and 40 millilitres of buffer solution of pH 4·0, five millilitres of 5% tannic acid were added and the sample was allowed to stand overnight, before a concentration method of digestion with sodium hydroxide was carried out. The concentrate was washed with normal saline solution before inoculation onto Petragnani's medium, and incubation was carried out at 37° C. for eight weeks. In winter it was found that less than 5% and in summer 10% of cultures were contaminated with moulds. The inhibition of organisms other than *Mycobacterium tuberculosis* was a great advantage, and the presence of acriflavine in the collection jar greatly improved the chances of uncontaminated cultures.

Distribution of Poliomyelitis Virus.

HAROLD E. PEARSON AND ROBERT C. RENDTORFF *et alii* (*American Journal of Hygiene*, March, 1945) have made three studies of the distribution of poliomyelitis virus. First, in the investigation of sporadic cases, a village where a single adult had contracted the disease was made the object of a detailed study. Samples of stools from humans and farm animals, insects, and samples of water and milk were tested for the presence of virus by monkey inoculation. Amongst the human stools, virus was recovered from the son of the patient, but from no other source. The authors' second study was made in a small town where poliomyelitis had not been seen for twenty-five years. Two children in widely separated points in the town contracted the disease, and all children under sixteen years of age were tested for virus. The brother and three cousins of the patient showed virus, and children in eight other families also gave material infective to monkeys. It was concluded from observations that personal contact seemed essential to account for spread of virus in the town. The authors' third study was made in the urban area of Fort Worth, Texas, during the epidemic of 1943, the town's largest experience of the disease. In a selected district search for virus was made from contacts of patients, domestic animals, pests, sewage and water supply. Virus was recovered from familial contacts in six of eight households, and from eight of forty-five households harbouring non-familial contacts. The only suggestive finding, apart from those associated with human stools, was the recovery of an agent which produced paralysis in mice and cotton rats from a pool of brain and intestines of Norwegian rats trapped on the city refuse dump. The nature of this agent was not determined.

Experimental Diphtherial Toxæmia in White Mice.

M. N. LEBEDEVA AND D. M. GOLDFARB (*The Journal of Microbiology, Epidemiology and Immunobiology* [Moscow], Volume VI, 1944) report that, by using an intracerebral method, they were able to prove that white mice are susceptible to diphtheria infection and that five minimum lethal doses were sufficient to kill all white mice (over 2,000) used in experiments. At the same time, when injected subcutaneously, even 100 minimum lethal doses produced no ill-effect. Their method was as follows: five minimum lethal doses of diphtheria toxin (or 0·05 ml of a twenty-four hour culture of diphtheria bacilli) were injected intracerebrally. The point of injection was selected on the middle line of the cranium, 2·0 to 3·0 millimetres above the eyes. A tuberculin syringe with a very fine needle was used for the injection. A piece of rubber was attached to the needle so that only 2·0 to 3·0 millimetres of the needle could penetrate beyond the cranium. For "control" animals normal saline solution, instead of toxin, was used. No ill-effect was noted after injection of the saline solution. Immediately after intracerebral injection the animal becomes very ill, but quickly recovers. The first symptoms of toxæmia appear after two to five days. These symptoms include loss of coordination of extremities, spasms and convulsions, rapid loss of weight, paralysis of hindlegs and then paralysis of forelegs, and diuresis. The majority of animals die in three to four days, some after seven to nine days. Two subcutaneous injections of antitoxin (1,000 units each), one made two hours before injection of toxin and another four hours after, saved 93% of the animals.

Epidemiology of Acute Respiratory Infections.

MORRIS SEIGEL, HELEN V. CARR AND L. A. JULIANELLE (*American Journal of Hygiene*, March, 1945) have continued their observations on the epidemiology of acute respiratory infections conditioned by sulphonamides in carrier epidemics due to sulphonamide-resistant pneumococci. In a colony of 130 feeble-minded children, half of those under observation were given 1·0 gramme of sulphadiazine every day for fifteen weeks, and 2·0 grammes every day for a further six weeks. Average blood concentrations were 3·4 milligrammes and 7·2 milligrammes *per centum* respectively. Cultures from the throat were made, and the pneumococci recovered were tested for their sensitivity to sulphadiazine over a range from 2·0 to 80·0 or 100·0 milligrammes *per centum* in beef heart phosphate broth with 2% horse serum, and also in McLeod's fresh liver medium. Observations were repeated two to three months after therapy, and eight to fourteen months after therapy. One immediate difference was observed—the treated children harboured many resistant strains of types 11 and 18A, while the untreated children harboured numerous other types of susceptible strains. When the type 11 strain was isolated from a treated child its resistance was high, while type 11 strain from an untreated child was susceptible. Sometimes untreated children possessed resistant strains, so that cross infection may have taken place. The mouse virulence of the resistant strains was low, 0·1 to 0·5 millilitre of an eight-hour broth culture being the lethal dose for mice. The carrier rate increased during the use of sulphadiazine, as many new contacts were being added to the population.

Antigens of Clostridium Welchii.

D. G. EVANS (*The Journal of Pathology and Bacteriology*, January, 1945) has studied the *in vitro* production of α toxin θ hæmolysin and hyaluronidase by strains of *Clostridium welchii* type A and the relationship of *in vitro* properties to virulence in guinea-pigs. Thirty strains were collected from varying sources and tested for the three factors, and for their virulence to guinea-pigs, groups of six animals being used for each strain. If the virulence was low, tests were repeated, larger doses of organisms being used. Eighteen strains proved virulent, one moderately virulent and eleven avirulent. Quantitative estimations of toxin production suggested that there was a direct relation between the ability to produce fatal gas gangrene in the guinea-pig and α toxin production, but θ hæmolysin and hyaluronidase production did not influence the effect on laboratory animals. It was found that strains not producing hæmolysin were non-hæmolytic when grown on horse blood agar plates, but if calcium chloride was added to the medium, partial hæmolysis took place; this was due to α toxin, and hæmolysis did not appear if antitoxin was added. Standard antitoxin was able to protect the animals from infection. There was no correlation at all between hæmolysin and hyaluronidase production and ability to produce fatal infection in guinea-pigs.

Anti-Rh Agglutinins.

LOUIS K. DIAMOND AND NEVA M. ABELSON (*The Journal of Laboratory and Clinical Medicine*, March, 1945) have evolved for the demonstration of anti-Rh agglutinins an accurate and rapid slide test. Large numbers of "Rh-negative" mothers whose "Rh-positive" infants show signs of *erythroblastosis*

fœtalis have serum in which either little or no agglutinin can be demonstrated by the test tube. The authors believed that there was evidence that the agglutinins were present, but were masked by some "inhibitor substance" whose action would be favoured by dilution of the agglutinogen, as carried out in the tube test. They therefore modified the test, and using a washed oxalated 50% emulsion of cells, they carried out the test on a slide; they used approximately 0·2 millilitre of cells to 0·1 millilitre of serum to be tested. The slide was mounted over a lamp, so that the reaction took place at 37° C. It was found that with varying concentrations of cells, a reacting serum could produce visible results with fifty cells, and no results when 20% cells were used. In a series of 22 sera submitted to the two methods, the slide test gave a positive result in twenty and a doubtful result in two instances, while the tube test gave a negative result in ten and a positive result in twelve instances. The authors claimed that the test more nearly approached conditions *in vivo*, permitted the use of testing sera formerly thought to be of little value, and demonstrated Rh sensitization in a higher percentage of sera than any other test.

HYGIENE.

Laboratory Criteria of the Cure of Typhoid Carriers.

R. F. FEEMSTER AND HELEN M. SMITH (*American Journal of Public Health and the Nation's Health*, April, 1945) report that in Massachusetts 68 typhoid carriers who had undergone cholecystectomy were closely studied. Of 55 proved carriers three could not be cured, and of thirteen probable carriers two retained their infections. In 46 of the 68 cases the success was immediate and permanent; in the rest the subjects ceased to have typhoid bacilli in the stools after periods of many weeks. Of the carriers, 19 were men and 49 were females. Fifty-one of the carriers had infected 198 persons. Mostly they (the carriers) were housewives, food-handlers, insane or nurses. The average onset was at 32 years. The bile test was used to test civilians.

Cheese Poisoning in Syria and the Lebanon.

A. BERBERIAN (*Revue médicale française du Moyen-Orient*, April, 1945) states that poisoning from cheese is the most common form of food poisoning in Syria and the Lebanon. He gives details of the method of manufacture of cheese by farmers, and shows how contamination can occur at any time from the milking of the cow, goat or ewe to the ingestion of the cheese by the victim. He shows why the popular belief that the poisoning is chemical in origin is erroneous, and points out that two type of poisoning occur, botulism and staphylococcal poisoning.

Ultra-Violet Light Control of Air-Borne Infection.

S. M. WHEELER *et alii* (*American Journal of Public Health and the Nation's Health*, May, 1945) report that ultra-violet fixtures were put in the barracks only of a naval training camp. The training period was four to six weeks and 4,800 recruits were housed in twenty-two two-story barracks, 112 to a floor. Half the barracks were thus fitted. The upper third of the room and the floor under the bunks were kept covered with ultra-violet radiation. The light was about similar to bright moonlight. Little ozone was produced after the first few weeks. When illness was worst the irradiated barracks showed a reduction of 25%. Bacterial counts and numbers of β hæmolytic streptococci in air and dust gave similar reduction. Streptococcal carrier rates were low and were not reduced.

Tuberculosis Mortality in the United States of America.

THE Bureau of the Census of the United States Department of Commerce (*Vital Statistics, Special Reports, National Summaries*, April 10, 1945) has published a table of the death rate from tuberculosis (all forms) in the United States per 100,000 of the population from 1923 to 1943 inclusive. In 1943 the rate was 42·6, dissected as follows: white population 34·3 (males 44·4, females 24·7), non-white 112·9 (males 126·4, females 100·0). In 1933 the rate was 59·6: whites 48·5 (males 54·3, females 42·6), non-whites 157·7 (males 165·6, females 149·9). In 1923 the rate was 91·7: whites 79·5 (males 84·4, females 74·5), non-whites 213·1 (males 206·3, females 220·0). The decline in the death rate in white males had been arrested in 1942 and the rate had risen slightly in 1943; the decline in the rate for all other groups had continued.

A Second Attack of Poliomyelitis after Thirteen Years.

J. WYLLIE (*Canadian Journal of Public Health*, April, 1945) states that a married woman, aged thirty-two years, became ill in October, 1942, with poliomyelitis which left some loss of power in the extensors of the right knee. She had an attack on September 28, 1929, after her sister had developed poliomyelitis on September 13. Wasting of the calf and flabbiness had then resulted. Nineteen cases have been collected from the hospital records (Kingston) during this century in which a second attack of paralytic poliomyelitis occurred.

Vaccination of Humans against Western Equine Encephalitis Virus.

MAXWELL BOWMAN (*Canadian Journal of Public Health*, May, 1945) states that in 1941 an epidemic of western equine encephalitis in Manitoba killed 68 out of 516 white persons affected. Early in June, 1942, 3,000 males, twenty-one years or more old, were given subcutaneously two doses of vaccine, one millilitre each one week apart, and a twenty millilitre specimen of blood was taken from 1,013 persons. Neutralizing antibodies were present in 20% of cases. Six weeks later 52·4% of persons showed evidence of antibodies. Similar results were obtained in 1943.

Current Problems in Filariasis.

H. W. BROWN (*American Journal of Public Health and the Nation's Health*, June, 1945) states that in the Virgin Islands 20% of men of military age were found with microfilaria in the blood stream, but without symptoms. Inflammatory reactions may be noted, fever and psychosomatic effects. The obstructive evidence, elephantiasis, is the exception. Rest in a cold climate greatly reduces the severity of the condition. Good results were obtained by intramuscular injections daily of anthiomaline 180 milligrammes (30 milligrammes of antimony) for two to four weeks. Marked reduction of filarial counts resulted. Sulphonamides are of use in any associated lymphangitis.

The Use of Propylene Glycol as a Bactericidal Aerosol.

J. M. MATHER AND A. D. MCCLURE (*Canadian Journal of Public Health*, May, 1945) have studied the incidence of upper respiratory sickness and throat carrier rate of streptococci showing a β zone of hæmolysis in an Air Force barracks in which 175 men were kept under observation. The floor area was 38 square feet per man. During three periods of four weeks the propylene glycol concentration was respectively nil, 0·1 milligramme per litre and over 0·1 milligramme. The incidence of sickness was low, but the addition of propylene glycol did not produce further lowering. Over 0·1 milligramme per litre was definitely germicidal, but tended to form a fog and condense on the windows. Maintenance of this concentration was not thought practicable. The highest air counts were noted during sweeping and the making of beds in the morning, and intermediate counts were noted while the men were changing and undressing.

MEDICINE.

Venesection for the Plethoric Patient.

L. E. HINES AND D. L. KESSLER (*Archives of Internal Medicine*, April, 1945) suggest that the use of venesection in the prevention and treatment of coronary thrombosis is rational. A study of 58 cases, in which there was either autopsy evidence or a series of electrocardiographic tracings typical of coronary thrombosis, revealed that only 8% of the patients had an erythrocyte count of less than 4,500,000 per cubic millimetre, and that in only 11% was the hæmoglobin content less than 13·0 grammes. The authors found an increase of the clotting activity as the erythrocyte count increased. Authorities are quoted to show that contrary to the former belief venesection provokes erythropoietic stimulation; small (100 to 500 millilitres) frequent bleedings of patients with *polycythæmia vera* controlled the symptoms and lowered the erythrocyte, hæmoglobin and hæmatocrit values without producing a significant rise in the reticulocyte count. The authors studied three patients—a normal control, a patient with *polycythæmia vera* and a patient with a recent coronary thrombosis. Small frequent bleedings after recent coronary thrombosis produced a lessening of the clotting tendency, as evidenced by an increase in the prothrombin time and an elevation in the heparin tolerance. The same results were obtained with the patient suffering from *polycythæmia vera*, a condition in which the tendency to thrombosis is well known. In contrast, the normal control showed no change in the prothrombin time, although the response to heparin was greatly reduced.

Medical Practice.

A MEDICAL SERVICE FOR DEPENDANTS OF DECEASED SERVICE PERSONNEL.

THE following letter from the General Secretary of the Federal Council with its accompanying document is published for the information of readers.

SIR: I shall be glad if you will publish in THE MEDICAL JOURNAL OF AUSTRALIA the enclosed copy of the agreement entered into between the Repatriation Commission and the Federal Council for the provision of medical services to dependants of deceased members of the armed forces whose deaths are attributable to war service, 1939.

Medical practitioners who are willing to provide service under the agreement are requested to notify the secretary of the State Branch of the Association as soon as possible.

Yours, etc.,

J. G. HUNTER,
General Secretary.

CONDITIONS OF MEDICAL SERVICES TO BE RENDERED BY MEDICAL PRACTITIONERS TO WIDOWS AND CHILDREN, INCLUDING STEP-CHILDREN AND LEGALLY ADOPTED CHILDREN, UP TO THE AGE OF 16 YEARS, OF DECEASED MEMBERS OF THE ARMED FORCES OF THE COMMONWEALTH AND WIDOWED MOTHERS OF DECEASED UNMARRIED MEMBERS OF THE ARMED FORCES OF THE COMMONWEALTH OF THE WAR WHICH COMMENCED ON 3RD SEPTEMBER, 1939, WHOSE DEATHS ARE ACCEPTED AS ATTRIBUTABLE TO WAR SERVICE.

AS APPROVED BY THE REPATRIATION COMMISSION AND THE FEDERAL COUNCIL OF THE BRITISH MEDICAL ASSOCIATION IN AUSTRALIA.

.....(Date.)

Conditions of medical service to be rendered by (name of Medical Officer), (hereinafter referred to as the Medical Officer) on behalf of the Repatriation Commission to widows and children, including stepchildren and legally adopted children, up to the age of 16 years, of deceased members of the Armed Forces of the Commonwealth and widowed mothers of deceased unmarried members of the Armed Forces of the Commonwealth of the war which commenced on 3rd September, 1939, whose deaths are accepted as attributable to war service, entitled to such medical service through the Repatriation Commission (hereinafter referred to as the beneficiary).

Clause 1. (*a*) Subject as hereinafter provided the Medical Officer shall, on behalf of the Repatriation Commission, give medical attendance to any beneficiary entitled to such attendance whose name is on the current list or for whom an entitlement card has been received by him from the Repatriation Commission, as hereinafter provided, in all cases of illness or injury.

(*b*) A beneficiary shall not be entitled to such medical attendance in any case where the illness or injury is occasioned by—

i. any misconduct, drunkenness or immorality, or
ii. the negligent act or omission of any person or corporation by reason whereof such beneficiary is entitled to claim compensation or damages in a Court of Law, or
iii. by personal injury sustained or disease contracted in respect of which the beneficiary is entitled to claim compensation under any Act of the Parliament of the Commonwealth of Australia or of any State of the Commonwealth in force for the time being.

(*c*) In the case of a beneficiary entitled to claim the compensation referred to in Sub-Clause (*b*) iii of this Clause (1), the Medical Officer shall render medical treatment, if required, pending a determination of such claim upon the basis that, upon a determination being made in favour of the claimant, the Medical Officer shall be entitled to payment from the beneficiary or his or her parent or guardian if an infant for treatment given in respect of the injury or disease to which the determination relates. Provided that if on any settlement or determination of a claim a specified sum shall be allowed in respect of any such claim to cover medical attendance and medicine, if supplied, then upon that sum being exhausted or expended the Medical Officer shall thereafter, when called upon, render medical attendance to the beneficiary to the same extent as if he had not been precluded therefrom by the provision of the said Sub-Clause (*b*) iii.

(*d*) The provisions of Sub-Clause (*b*) iii shall only apply to the individual claimant and shall not be construed so as to deprive any other beneficiary of the benefit of the services of the Medical Officer.

(*e*) The Repatriation Commission shall supply to the Medical Officer a list and entitlement cards of beneficiaries to be attended by him during the next succeeding quarter, and no name shall be added to or removed from the list during any quarter. Provided always that in the case of a person not being a beneficiary at the commencement of a quarter becoming a beneficiary during the currency of the quarter and desiring medical benefits under this Agreement, his or her name shall be added to such list forthwith. The entitlement card shall show not only the name of the widow and the Repatriation Commission registration number, but also the names and date of birth of each beneficiary of a family unit hereinafter defined under the age of 16 years.

(*f*) After the Repatriation Commission has furnished the Medical Officer with the first list and entitlement cards of beneficiaries to be attended by him during the next succeeding quarter, the only notice of additions to or deletions from such list shall be the sending of additional entitlement cards for new beneficiaries and requests for return of entitlement cards of those beneficiaries no longer eligible to be attended by him under this Agreement.

(*g*) The Medical Officer shall, during each quarter, be required to attend as aforesaid such beneficiaries only as are named on the list and/or for whom he holds entitlement cards supplied by the Repatriation Commission and in respect of whom the Repatriation Commission makes payment as hereinafter provided. In the event of the Repatriation Commission ceasing to make such payment in respect of any beneficiary at any time, the beneficiary's entitlement card shall be withdrawn, and such beneficiary shall not be eligible for medical attention by the Medical Officer under this Agreement for any succeeding quarter.

(*h*) The list form and entitlement cards used for the purpose of supplying names of beneficiaries to the Medical Officer shall be printed or typed.

(*i*) In case of the death of a beneficiary, payment of medical fees shall be made only up to the date of death. Provided that this clause shall not affect the liability to continue to pay fees in respect of the remaining members of the family unit hereinafter defined if the deceased was a member of a family unit of more persons than one.

(*j*) The Repatriation Commission shall supply to the Medical Officer a block of prescription forms to be used by him for the prescribing of medicines, drugs, serums, vaccines, biological products, dressings, etc., necessary for the treatment of beneficiaries under this Agreement. The prescription forms shall be printed and shall be made out in triplicate (carbon paper being provided), and where dispensing is done by a pharmacist, two copies will be handed to the patient for presentation to the pharmacist. When receiving the medicine, etc., the patient shall sign the receipt at the foot of the prescription form. Where the Medical Officer dispenses his own prescriptions or supplies any of the drugs, serums, etc., the same prescription forms shall be used and the patient's signature obtained. In these cases the prescription form signed by the patient shall be attached to the claim made by the Medical Officer for payment as hereinafter provided.

The above clause in respect of the prescribing of medicines, drugs, serums, etc., under this Agreement shall be reviewed if a Pharmaceutical Benefit Scheme for the whole community be introduced.

(*k*) Wherever possible, only medicines, drugs, serums, etc., contained in the British Pharmacopœia and the Australian Pharmaceutical Formulary shall be prescribed.

2. The Medical Officer shall supply such medicines, drugs, serums, etc., of the British Pharmacopœia and/or the Australian Pharmaceutical Formulary, and such surgical dressings as may be necessary, together with such splints for fractures, dislocations, or other injuries as are commonly kept by a medical practitioner for use in emergency, but he shall not supply free of cost bottles or other vessels for dispensing. Provided that, when medicines are sent, at the request of a beneficiary or his or her parent or guardian, the beneficiary or his or her parent or guardian if an infant shall pay the cost of carriage. Payment to the Medical Officer for the supply of medicines, drugs, serums, etc., prescribed under this Agreement, shall be in accordance with the Agreement made between the Repatriation Commission and the Australian Pharmaceutical Society for the supply of medicines, drugs, serums, etc., under this Agreement. A copy of the Agreement will be sent to each Medical Officer necessarily dispensing his own prescriptions.

(This clause to be deleted when the Agreement is for medical attendance only.)

3. All beneficiaries requiring medical attendance, who are physically able to do so, shall visit the Medical Officer at his consulting room during the hours he has set apart for consultation, but urgent cases shall be attended as soon as possible.

4. The Medical Officer shall visit any beneficiary not physically able to attend at his consulting room if a written message stating name, address and telephone number and, if possible, the nature of the illness or injury shall have been delivered at his residence or consulting room before 10 a.m. In a case of urgency, in which it is not possible for such message to be delivered before 10 a.m. as aforesaid, it may be delivered later, and, if a written message, must be marked conspicuously with the word "urgent".

5. The Medical Officer, if possible, shall, whenever he cannot in all reasonable circumstances attend personally, provide a qualified substitute, and the Repatriation Commission agrees to accept such substitute.

6. If the beneficiary be visited professionally by any other practitioner without the consent of the Medical Officer, while under the Medical Officer's medical or surgical attendance, save in the cases of sudden emergency or if in any emergency case any other practitioner has visited the beneficiary, and the Medical Officer has not been informed at the time of the circumstance and of the name of the practitioner called in, or if the instructions and treatment ordered by the Medical Officer are disobeyed, then the Medical Officer is at liberty to cease attendance for the period of that particular illness.

7. The Medical Officer shall give, free of charge, such certificates as may be required by the Repatriation Commission for its own use. Other certificates shall be paid for by the beneficiary or his or her parent or guardian if an infant, as per arrangement between the beneficiary or his or her parent or guardian if an infant and the Medical Officer.

8. In consideration of the Agreements on the part of the Medical Officer herein contained, the following fees shall be paid to the Medical Officer by the Repatriation Commission, such fees to be subject to adjustment in accordance with the terms of condition 9 hereof.

(a) In respect of beneficiaries residing within the metropolitan areas as hereinafter defined, quarterly fees at the rate of 32s. per annum for each family unit as hereinafter defined on each quarterly list of beneficiaries supplied by the Repatriation Commission to the Medical Officer as aforesaid, and/or for whom he holds entitlement cards. The expression Metropolitan Areas shall mean:

In New South Wales.—Such portion of the State of New South Wales as shall be deemed to be included within the following boundary, that is to say, a boundary commencing at Rocky Point, on George's River, bounded thence in a general westerly and northerly direction by the northern and eastern shores of that river and adjoining bays to the eastern bank of Orphans' School Creek; thence by that bank of that creek in a general north-westerly direction to the south-eastern side of Woodville Road at Lansdowne's or Bowler's Bridge; thence in a general northerly direction by that side of that road to the south-west boundary of the Municipality of Granville; thence in a north-westerly direction by that boundary of that Municipality; thence in a general northerly direction by the lines dividing the Municipality of Holroyd from Granville and Parramatta to the main Western Road; thence by the northern side of the main Western Road to its junction with Seven Hills Road; thence by the eastern side of Seven Hills Road to its junction with the Main Northern Road; thence by the north-eastern side of that road northerly to its junction with the Castle Hills Road at Rogan's Hill; thence by a straight line in a north-easterly direction about five miles to Hornsby Railway Station; thence by a straight line in an easterly direction about twelve miles to the southern side of the entrance to Narrabeen Lagoon; thence in a general southerly and westerly direction by the shore lines of the Pacific Ocean and Botany Bay to the point of commencement. Including also all that area within a radius of half a mile from Hornsby Railway Station not included in the above description.

In Queensland.—Greater Brisbane Area which includes the whole of the city proper, all suburbs and certain rural districts in the immediate vicinity of Brisbane, within the circle embodying Manly, Oxley, Sunnybank, Pine River, Sandgate, Bald Hills, Enoggera, Toowoomba, Maryborough, Ipswich, Rockhampton.

In Victoria.—Melbourne and suburbs, but not including the suburbs of Dandenong, Eltham, Greensborough, Ringwood, Mitcham, Ballarat, Bendigo, Geelong.

In South Australia.—Adelaide and suburbs.

In Western Australia.—Perth and suburbs within a radius of 20 miles.

In Tasmania.—City areas of Hobart and Launceston.

(b) In respect of beneficiaries residing outside the Metropolitan Areas as hereinbefore defined, quarterly fees at the rate of 39s. 5d. per annum for each family unit on each quarterly list of beneficiaries supplied by the Repatriation Commission to the Medical Officer as aforesaid.

The expression "family unit" used in these conditions shall mean one or more beneficiaries who is or are the widow and/or child or children (including stepchild and stepchildren and legally adopted child or children) of a deceased member of the Armed Forces or the widowed mother of a deceased unmarried member of the Armed Forces, provided that, in the case of a family unit consisting of more than one beneficiary, the members thereof reside together.

9. The annual rate of fees is to be adjusted annually for a period from the first day of July to the thirtieth day of June in the following year, according to the Commonwealth Statistician's Nominal Wage Index Number; such Nominal Number shall be computed on the average Index Number for the calendar year immediately preceding the first day of July of the year for which the annual rate of fees is to be calculated, such average Index Number to be obtained by averaging the four quarters of the calendar year. On the Nominal Wage Index Number being so ascertained, the annual rate of fees for the period from the 1st July to the following 30th June shall be calculated by taking such new Nominal Wage Index Number and multiplying the annual rate of fees for the preceding year therewith and dividing the result by ..... (the Nominal Wage Index Number for the preceding year).

10. The Medical Officer shall meet in consultation when so required any other legally qualified medical practitioner who is eligible for membership of the British Medical Association. When it is arranged between the Medical Officer and a beneficiary or his or her parent or guardian that the services of another medical practitioner shall be obtained for the assistance of the Medical Officer, either by way of consultation or otherwise, the payment for such service shall be the sole responsibility of the beneficiary or his or her parent or guardian if an infant and no responsibility devolves on the Repatriation Commission in this regard. And, when the Medical Officer is required as aforesaid to meet another legally qualified medical practitioner in consultation, he shall be entitled to a fee of 10s. 6d., which is payable by the beneficiary or his or her parent or guardian if an infant. The payment of this special fee is the sole responsibility of the beneficiary or his or her parent or guardian if an infant and no responsibility devolves on the Repatriation Commission.

11. The Medical Officer may, when required, give special services, payment for which shall be as per arrangement between the beneficiary and his or her parent or guardian if an infant and the Medical Officer. The payment for such special services shall be the sole responsibility of the beneficiary or his or her parent or guardian if an infant and no responsibility devolves on the Repatriation Commission. Wherever practicable the amount of such payment for a special service shall be stated by the Medical Officer before rendering the special service. Special services, for which the Medical Officer is entitled to payment by a beneficiary or his or her parent or guardian if an infant, include attendance at confinement or premature birth or miscarriage, or administration of anæsthetics or attendance in case of fractures or dislocations, or electrical treatment or examination by X rays or surgical operations other than minor operations not requiring an anæsthetic, or the after treatment following such operations. (A minor operation in which local anæsthesia is produced by means of what is known as local freezing shall be deemed an operation not requiring a local anæsthetic.)

12. In any case in which the Medical Officer shall visit as hereinbefore provided at a place more than three miles distant from his residence, he shall be entitled to charge mileage as a special service at the rate of 3s. 6d. per mile for every mile or fraction thereof beyond such three miles travelled on the outward journey in the day-time and 5s. per mile or fraction thereof travelled in the night-time. For the purpose of this Agreement, night-time shall be from 6 p.m. to 8 a.m. This mileage charge shall be the sole responsibility of the beneficiary or his or her parent or guardian if an infant and no responsibility for the payment devolves upon the Repatriation Commission.

13. Nothing in these conditions or in the Agreements of the Medical Officer herein contained shall require the Medical Officer to give or render to any beneficiary medical or

surgical treatment, attention or service of a nature or kind not usually given by the Medical Officer in the normal course of his practice.

14. When any beneficiary or the parent or guardian of any beneficiary if an infant requests the attendance of the Medical Officer between 6 p.m. and 6 a.m., the Medical Officer shall be entitled to the payment of a special fee of 5s. for such attendance, provided that such fee of 5s. shall not be payable in any case where mileage is paid. The payment of this special fee is the sole responsibility of the beneficiary or his or her parent or guardian if an infant and no responsibility devolves upon the Repatriation Commission.

15. No beneficiary shall be transferred to the list of the Medical Officer from the list of Medical Officer in another place so as to be entitled to medical attendance by the Medical Officer unless he or she comes to the place of the Medical Officer's practice as a bona fide resident, that is to say, with the intention of residing there for at least twelve months, or unless he or she comes there to reside with the object of following his or her usual avocation. Provided always that should application be made by a beneficiary or his or her parent or guardian if an infant for medical attention under this Agreement during temporary residence in another locality, the Repatriation Commission, while continuing the payment as hereinbefore provided to the ordinary Medical Officer, may, subject to the prior approval of the Medical Officer in the locality of the temporary residence of the beneficiary, add the name of the beneficiary to the list of those entitled to treatment by him under this Agreement. Payment shall be made to the Medical Officer in the locality of the temporary residence of the beneficiary, at the rate hereinbefore set out, concurrently and in addition to the payments already being made to the Medical Officer in the locality of the permanent residence of the beneficiary.

16. No beneficiary shall be entitled to the services of the Medical Officer unless his or her name is on the list, furnished as aforesaid, or the Medical Officer has received an entitlement card from the Repatriation Commission.

17. Except where otherwise provided, all fees payable by the Repatriation Commission shall be paid by the Repatriation Commission to the Medical Officer quarterly, and the fees for each quarter shall be paid within fourteen days of the end of the such quarter.

18. The Medical Officer shall be entitled to have a beneficiary's name removed from his list and/or to return the entitlement card to the Repatriation Commission at the end of a current quarter, provided—

(a) the beneficiary is not actually under attention for a specific illness;
(b) the reason for such removal is not on medical grounds;
(c) the beneficiary has the right of appeal to the Repatriation Commission.

19. In the event of any dispute arising from arguable matters both on the part of the Medical Officer or beneficiary, the complainant shall report such matters to the Repatriation Commission, which shall arrange for the full circumstances of the complaint to be referred to a committee composed of representatives of the Repatriation Commission and the British Medical Association in the State in which the dispute occurred.

20. A person shall only be entitled to have medical benefits as a beneficiary under these conditions where application for the same has been made within a period of six months from the date of acceptance of the death of the member of the Armed Forces who was the husband, father, stepfather, father by adoption or son of such person by the Repatriation Commission, unless the Medical Officer after medical examination of the beneficiary and/or of all members of a family unit shall agree to accept the beneficiary and/or any of the members of the family unit for attention under this Agreement. The fee for each such medical examination shall be 2s. 6d., which shall be paid by the beneficiary or his or her parent or guardian if an infant at the time of such examination, and the Medical Officer shall be entitled to defer acceptance of the beneficiary for attention under this Agreement until the examination fee shall have been paid.

21. Each of them, the Medical Officer and the Repatriation Commission, shall, upon giving to the other of them six months' notice in writing, be at liberty at any time to determine the Agreements and obligations herein contained, subject always to the termination of this Agreement should the beneficiaries become entitled to medical attendance under a national or State governmental scheme.

To be signed by the Medical Officer and on behalf of the Repatriation Commission by an authorized officer.

Obituary.

JAMES THOMAS WILSON.

WE are indebted to Professor A. N. Burkitt for the following appreciation of the late Professor James Thomas Wilson.

Professor J. T. Wilson died on September 2, 1945, at Cambridge, England, after a short illness, at the age of eighty-four. He was one of the most distinguished of the founders of the medical school of the University of Sydney, and will long be remembered by older generations of graduates of that school. He was a man of outstanding personality, tall and spare, with a slight student's stoop and a long somewhat austere face, except when lit by a disarming smile. Although not a fluent speaker, especially in his younger days, nevertheless with his deep voice, his fervour and his passion for accuracy and thoroughness in both observation and speech, he inspired respect and enthusiasm and perhaps even at times not a little fear in the case of delinquent students. In face, figure and fluency of speech he mellowed greatly as the years went on, especially during the final period of his life in England. He became one of the leaders in scientific thought in Australia and Great Britain, both in his own field of human anatomy and also in the wider field of comparative vertebrate anatomy. By the intense thoroughness of his teaching, by the philosophical breadth of his outlook and by his own personal character, he wielded an immeasurable influence on many hundreds of medical men throughout Australia, and it was to Wilson that we owe the foundations of a school of human anatomy which, in the short space of fifty-five years, has produced eight professors of anatomy, including such figures as those of Grafton Elliot Smith and John Irvine Hunter.

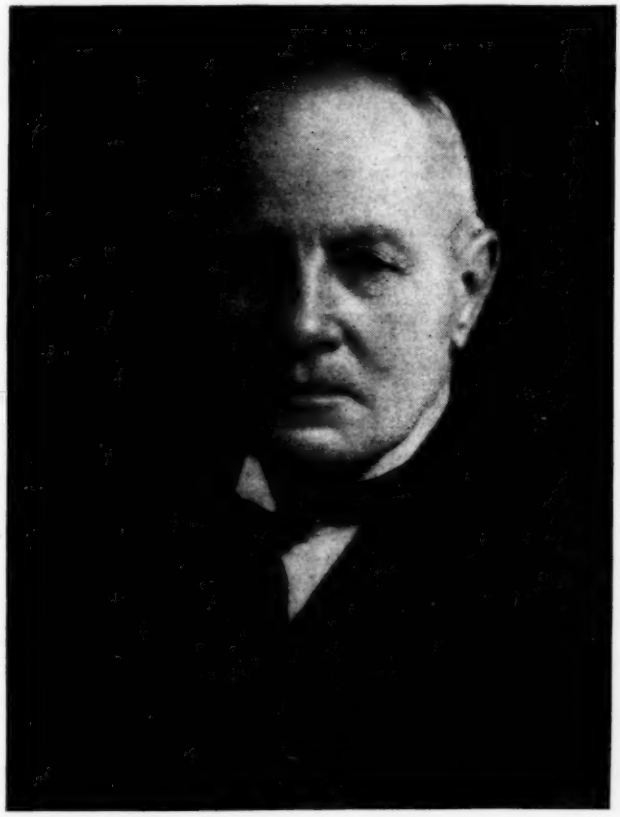
His life may be divided into three periods: (i) his early life, his student days and his short teaching period in the University of Edinburgh (1861 to 1887), (ii) the thirty-three years in the University of Sydney (1887 to 1920), and (iii) the final phase from 1920 to 1945, first as Professor and later as Professor Emeritus in Cambridge. For many of the facts in all three periods I am particularly indebted to Professor J. P. Hill's biographical sketch written on the occasion of the dedication of Volume LXXVI of the *Journal of Anatomy* to Wilson in 1941, and also to his eldest daughter, Mrs. J. Clunies Ross, to Dr. Robert Scot Skirving and many others.

Born on April 14, 1861, at Monialve, in Dumfriesshire, his father, Thomas Wilson, the parish schoolmaster, first taught him. Wilson's interests in the natural sciences and in biology he owed especially to his father, who was a keen astronomer, and also to a friend of his father, a Dr. Grierson, in the neighbouring village of Thornhill. Grierson was a remarkable if rather eccentric man, an authority on the local fauna and flora as well as on the local antiquities, and the founder of a local museum which bears his name. Wilson went to Edinburgh in 1879, matriculating at the age of eighteen, and entered medicine.

Among his teachers were Sir William Turner (anatomy), W. Rutherford (physiology), Sir Thomas Frazer (*materia medica*), W. S. Greenfield and Sims Woodhead (pathology), and in the later clinical years, Professor Grainger-Stewart, Professor Annandale, Professor Simpson, Professor Douglas Maclagan and Professor John Duncan. Among his contemporaries were his friends and fellow students the two Haldanes—the one J. S. Haldane, physiologist and philosopher, the other Lord Haldane, statesman and philosopher; also J. Lorrain Smith, his future brother-in-law, Robert Scot Skirving (Sydney), Arthur Thompson, late professor of anatomy at Oxford, and the late F. Antill Pockley, of Sydney. The first three were keen students of philosophy and remained his life-long friends. With them he acquired a deep-rooted interest in the problems of philosophy, which he never lost, and which contributed in no small measure to that broad outlook on men and affairs which was one of his most striking characteristics. Other fellow students later to become famous were Sir Arthur Conan Doyle, Sir Alexander MacCormick and Sir David Orme Masson.

According to the Edinburgh University Calendar, he graduated on August 1, 1883, with second-class honours. Fellow graduands on that same day were Arthur Robinson and A. Melville Paterson, both of whom later became professors of anatomy and also presidents of the Anatomical Society. He then spent the winter session at the Royal Infirmary, Edinburgh, as house surgeon under Dr. John Duncan. He was an enthusiastic disciple of Duncan and

had won his prize. Next he signed on for a year as surgeon to a cargo ship trading to the east as far as China, and read philosophy on the voyage. On his return to Edinburgh he was appointed demonstrator of anatomy by Professor Turner, later to become the famous Sir William Turner. He demonstrated in 1885 and 1886, and the excellence of his lectures on osteology and the thoroughness of his instruction in the dissecting room gained for him the confidence and approbation of Turner. Towards the end of 1886, the late Sir Thomas Anderson Stuart, then Professor Stuart, offered him the post of demonstrator in anatomy in the newly formed medical school of the University of Sydney. Stuart was then professor of anatomy and physiology in the new school which he was busily engaged in founding. After consulting with his chief, Turner, Wilson accepted and arrived in Sydney in the early part of 1887, on the same ship as Professor M. W. MacCallum, later Sir Mungo MacCallum, who had been appointed to the chair of English. Thus commenced a friendship which lasted till the death of MacCallum in 1942. Late in 1920, MacCallum wrote a remarkable appreciation of Wilson, on the occasion of Wilson's leaving Sydney to go to Cambridge, from which I shall occasionally quote.



Thus began the first great constructive period of his life. When Wilson arrived the new medical school was being built and was completed in the following two years. In 1890 a new chair of anatomy was created, endowed from the Challis bequest, and Wilson became its first occupant, at the early age of twenty-nine. Johnson Symington, later of Belfast, and H. St. John Brooks were also candidates for the position. In the same year, Wilson was elected a member of the recently formed Anatomical Society, and became its first overseas member.

In the new school, the department of anatomy occupied a series of spacious rooms on the first floor, with its museum at first on the ground floor; later this museum, now called the Wilson Museum, was transferred to the first floor. Thanks to the wide outlook and organizing ability of the new professor, the new department was in its equipment and facilities for teaching and research far in advance of any comparable department in Great Britain at the time. In 1891, C. J. Martin (now Sir Charles Martin, and one time Director of the Lister Institute in London) arrived in Sydney as demonstrator of physiology in succession to Almroth Wright (also knighted later). He and Wilson soon collaborated in investigations on the anatomy of the snout of the platypus and the structure of the peculiar tactile organs that occur in the skin of its bill, and later they wrote a second paper which adequately dealt with the strictures of Professor E. B. Poulton. Then, in 1892, J. P. Hill (ultimately to become Jodrell Professor of Zoology and Comparative Anatomy and later Professor of Histology and Embryology at University College, London) came to Sydney as demonstrator in biology under Haswell. Then, as Hill himself says, with the encouragement and generous help offered him by Wilson and Martin, he, too, in the course of a year or two was enabled to become a member of their research team. Hill also records his indebtedness to and friendship with Wilson in his biography of Wilson:

> I feel I cannot conclude this wholly inadequate sketch of my old friend without acknowledging the debt I myself owe him for the encouragement, help and inspiration I have received from him and for the friendship he has accorded me over a period now bordering on fifty years.

I have quoted the above fully, because it so adequately describes what may be considered as one of the keynotes of Wilson's whole life, the help and inspiration he gave to so many people right up to the end of his life. Hill and Wilson published several important papers upon marsupial and monotreme development.

In 1894, Grafton Elliot Smith, a pupil of Wilson's, was invited to join the staff as demonstrator of anatomy, and was soon hard at work examining monotreme and marsupial brains and laying the foundations of his future brilliant career as a comparative neurologist. In the same year Wilson published his monograph on the musculature of the forelimb in the Australian marsupial mole, *Notoryctes*, and was elected an Honorary Fellow of the Royal Society of South Australia, in whose journal this monograph was published. Amongst other workers in these early days may be mentioned F. Tidswell, who with Martin studied the structure and function of the femoral gland in monotremes, and W. J. Stewart McKay, also a former pupil, who collaborated with Wilson in work on the homologies of the monotreme scapula and also published a detailed account of the musculature of the monotreme shoulder girdle.

Meanwhile Wilson was developing other fields, as shown by his observations on early human embryos and his studies of Australian aboriginal skulls and his controversy with Ruge upon the innervation of the *Achselbogen* muscle and also by his observations upon the fourth ventricle in the human brain. His general philosophical outlook is indicated by his two presidential addresses to the Linnean Society of New South Wales in 1898 and 1899, while an indication of his broad outlook upon student and university life is given by his presidential address to the Students' Union in 1902, in which he discusses the wider aspects of a university education and especially takes up the cudgels in support of a training in scientific method. In this address he says, "in matters pertaining to the domain of knowledge, at all events, it is absolutely essential that at some point we should be in touch with reality at first hand", and again, "hence arises the unconditional necessity for including original observation, experiment or practical exercise in our systems of instruction of whatever kind, primary, secondary, technical or university", and finally, "the fallacy that the practical results of research of any kind can be made thoroughly and effectively our own, and that vigorous and reproductive life can be indefinitely sustained upon second-hand material, is one of the most pernicious and suicidal that can possibly be entertained". These propositions are particularly pertinent today.

Continuing Hill's account:

> These were days of intensive activity, often prolonged far into the night and relieved during vacations by camping expeditions into the bush in search of monotreme and marsupial material.

During the ensuing years, Wilson's colleagues in the university came to rely more and more on his sound judgement and wide outlook on university affairs, while his reputation as an anatomist steadily increased. In 1909, much to the joy of his friends, his research work received its due recognition by his election into the Fellowship of the Royal Society.

With his high sense of public duty and in a circumscribed though growing community like that of Sydney, it was inevitable as time went on that more and more burdens of administrative work, university and other, should be thrust upon him. For ten years he was a Director of the Royal Prince Alfred Hospital, and its Honorary Secretary for three years.[1] He was President of the Linnean Society of N.S.W. in 1898 and 1899, a Trustee of the Australian Museum, Chairman of the Professorial Board of the University of Sydney for two four-year periods, and finally a Fellow of the University Senate and Acting Dean, and then Dean of the Faculty of Medicine.

He is competently asserted to have been the ideal chairman of the Professorial Board. At the end of 1912 he went to England and the Continent for a year and attended the International Medical Congress in London. In 1914 came the war, and the first Australian meeting of the British Association for the Advancement of Science. At this meeting he and the late Sir Edgeworth David first showed the Talgai skull, later bought for the department of anatomy by the late Sir Joynton Smith.

He had always taken an active interest in military affairs, dating from his Edinburgh days, when he was a member of the University Volunteers. For nine years he held commissioned rank in the New South Wales Scottish Rifles (later Fifth Infantry Regiment, C.M.F.), ending up as major and second in command of the battalion. From 1907 to 1912 he was in command, first as major and then as lieutenant-colonel, of the Australian Intelligence Corps, Second Military District, and Sir Mungo MacCallum writes: "It is not generally known that the comparative efficiency of the Intelligence Department in N.S.W. when the war broke out was largely due to him." On the outbreak of the Great War, 1914-1918, he was called up to organize the New South Wales Branch of the censorship, and was promoted honorary colonel in 1915. In the same year he was appointed chairman of the New South Wales Branch of Commonwealth War Propaganda. During most of the war period, Dr. S. A. Smith was Acting Professor of Anatomy, and Wilson generously entrusted to him the scientific description of the Talgai skull.

No account of Wilson's thirty-three years in Sydney would be complete without mention of the great technician, Louis Schaeffer, whom Wilson trained from boyhood and who predeceased his master by three years.

Then in 1920 he had to make what must have been one of the most difficult decisions of his life. In that year the chair of anatomy at Cambridge became vacant through the death of Alexander MacAlister, and Wilson's many friends in Great Britain urged him to allow his name to be submitted to the Board of Electors. He might well have declined, for he had now spent thirty-three years of his life in Sydney and was deeply attached to his adopted country by strong family ties and many bonds of friendship. Moreover, he had built up a flourishing department, he was dean of the faculty of medicine and commanded the trust and esteem of all members of the university, so that his elevation to the highest administrative office the university had to offer seemed only a question of time. It must have been for him no easy decision; but what his friend Sir Mungo MacCallum has termed his "practical idealism" enabled him to put these personal considerations on one side. He allowed his name to go forward and he was duly elected. With amazing fortitude, at the age of fifty-nine, he pulled up his roots and returned to the Motherland.

The outstanding service he now rendered to anatomy and to Cambridge during his tenure of the chair there is perhaps not so well known to Australians. On his arrival in Cambridge, he was elected a Fellow of Saint John's College, "where this lovable and great-minded man enjoyed the privilege, though now elderly, of performing the traditional duties assigned to the most junior Fellow". (Obituary notice, *The Times*, September 4, 1945.) With characteristic energy and in the face of great inherent difficulties, he set about the reorganization of the old department there, and within a remarkably short space of time he had created what amounted to a new anatomy school, fully staffed and adequately equipped and provided with an excellent library enriched by many of his own books, periodicals and reprints. On the teaching side he instituted most efficient instructional courses to meet the needs of the large number of students who at that time took anatomy as one of their subjects in Part I of the Tripos examinations, and such was the effect of his teaching that each year a small group of men elected to take anatomy, never a popular subject, for Part II of the same examination. These men were fortunate; for them Wilson, as ever, gave of his best. Meanwhile he continued his research work, and published a useful summary upon the innervation of striated muscle and a penetrating critique on the development of *Cavia*. He had always been interested in laboratory methods, and while in Sydney had published various notes on technique. This interest was sustained at Cambridge, where he developed his microscope table for rapid examination of slides or whole objects by varying illumination.

During the years 1922-1924 he was president of the Anatomical Society of Great Britain and Ireland, and by his charm of manner and urbanity no less than by his learning, worthily upheld the high traditions of that office. The summer meeting held at Cambridge during his presidency and at his invitation was one of the most successful ever held by the society. He was now a member of the Council of the Royal Society and representative of the Australian universities in Great Britain. He also acted as adviser to the Carnegie Trust in Great Britain up till quite recently. In 1926, his *Alma Mater* conferred on him the honorary degree of doctor of laws. In the Australian winter of 1930 he paid a short visit to Sydney to see his family. His home and his department in Cambridge became a Mecca for visiting Australian scientists and medical men, and continued so up till the time of his death.

After his retirement in 1934, he continued to live on at Cambridge, and kept up a vigorous correspondence with his old students and friends all over the world up to the end of his life. In 1941, on the occasion of his eightieth birthday, as has already been mentioned, Volume LXXVI of the *Journal of Anatomy* was dedicated to him, and many of his old students contributed to it. He was named the Nestor of British anatomy, and received congratulations from all over the world.

Turning now to some general appreciation of his character and abilities, in 1920 Sir Mungo MacCallum wrote of him:

> His proficiency in his own department has been known to generations of medical students and graduates, who owe to him the broad and solid foundations of their professional knowledge. But not a few of these declare that their obligations to him are far deeper and that the spirit of his teaching has helped them to realize the ethics of their profession, its dignity, its responsibility, and its value for the service of man.

Speaking of his intellectual qualifications, MacCallum remarks that he possesses these in exceptional degree, and continues: "They would seem to fall under two heads, grasp of thought and width of outlook"; and later:

> It has been said that the truly cultured man ought to know everything of something and something of everything; and few have approximated more nearly to that impossible definition than Professor Wilson. He has an appreciative acquaintance with good literature, he is all but a professional student of philosophy, he is not indifferent to educational theory; he has occupied himself with the enigmas of primeval history, he is not unfamiliar with the processes and results of Biblical criticism. Some of these topics are a little remote from the urgent life of the present, but neither is that omitted from Professor Wilson's purview. The problems of the Pacific, of the British Commonwealth of Nations, of international relations and world politics have also attracted him, and to good purpose, as those who have had the privilege of listening to his pertinent suggestions are aware.

It is fitting to remark that Wilson repaid this tribute by a long appreciation of MacCallum written only last year after MacCallum's death.

Professor J. P. Hill's tribute to his abilities is well summed up in his concluding words:

> No one who has read Professor Wilson's papers or heard him speak can fail to be impressed by his gift of lucid expression, by his breadth of view, by his complete grasp of the essentials of the subject in hand and by his capacity for balanced and critical judgement. At times, especially in debate, he may seem to be expressing his views in the most uncompromising fashion, but that is only a Wilsonian mannerism, a relic perhaps of his

[1] He was also the first pathologist to the same hospital.

ancestry and upbringing. In reality, he is never one-sided or partisan in his judgements and is quite open to argument, though a difficult man to argue with or convince, since his own views have been reached only after mature consideration of all available evidence. The present writer [Hill] speaks from dire experience, for the story used to be current in Sydney that when Professor Wilson and he were at work together, the voice of one of them could be heard declaiming over a radius of at least a quarter of a mile.

His scientific endeavour is only very partiallly shown by the list of researches appended. Going far beyond this is the inspiration and encouragement he gave to many hundreds of students. Many of them, in both Australia and England, have made great contributions to anatomical and medical science or have occupied important teaching posts, such as the late Sir Grafton Elliot Smith and G. H. S. Lightoller, the late Norman Royle and F. P. Sandes, S. A. Smith, F. A. Maguire, Professors R. A. Dart, J. L. Shellshear, W. A. Fell, H. L. H. H. Green, F. Goldby and Una Fielding, to mention only some of his old students in Sydney and Cambridge. Known affectionately if irreverently as "Jummy" to his students in Sydney, he will long be remembered and respected by more than one generation of medical men in Australia. In conclusion, I should like to express my own indebtedness to Wilson. His intense earnestness, his scientific integrity and outlook coupled with his tolerance and kindly counsel, had a profound influence on me during my student and later years. All of us who came in contact with him will treasure our memories and the privilege of having known a great man.

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ISAAC GEORGE.

WE regret to announce the death of Dr. Isaac George, which occurred on November 28, 1945, at Mandurah, Western Australia.

COLIN MOORCRAFT SWIRLES.

WE regret to announce the death of Dr. Colin Moorcraft Swirles, which occurred on December 7, 1945, at Turramurra, New South Wales.

DUDLEY STEWART SMALL.

WE regret to announce the death of Dr. Dudley Stewart Small, which occurred on December 27, 1945, at Casino, New South Wales.

JULIUS EDWARD STREETER.

WE regret to announce the death of Dr. Julius Edward Streeter, which occurred on January 2, 1946, at East Brisbane.

Nominations and Elections.

THE undermentioned have applied for election as members of the New South Wales Branch of the British Medical Association:

Church, John Campbell, M.B., B.S., 1941 (Univ. Sydney), 10, Toongarah Road, North Sydney.
Galley, William George, M.B., B.S., 1938 (Univ. Sydney), Stratton Hall, 26, Simpson Street, Bondi.
Dunn, Eric Robert, M.B., 1945 (Univ. Sydney), 27, Cowper Street, Randwick.
Collins, Ian Stuart, M.B., B.S., 1945 (Univ. Sydney), Royal Prince Alfred Hospital, Camperdown.
Graham, David Lindsay, M.B., B.S., 1940 (Univ. Sydney), 16, Edward Street, Gordon, New South Wales.
Barker, Hilda, L.R.C.P., L.R.C.S., 1937 (Edinburgh), L.R.F.P.S., 1937 (Glasgow), c.o. 14, Wallace Street, Waverley, New South Wales.
Stephenson, Noel Lavender, M.B., B.S., 1943 (Univ. Sydney), 93, Bathurst Street, Sydney.
Boydell, William Herbert, M.B., B.S., 1945 (Univ. Sydney), Western Suburbs Hospital, Croydon.

Books Received.

"Nursing in Acute Infectious Diseases", by Frank V. G. Scholes, C.M.G., M.D., B.S. (Melbourne), D.P.H. (Cambridge), F.R.A.C.P.; Second Edition; 1945. Sydney: Australasian Medical Publishing Company, Limited. 8¼" × 5½", pp. 338. Price: 16s.

"Now Blame the Farmer", by Hugh S. Robertson; 1945. Sydney: Angus and Robertson Limited. 7¼" × 5", pp. 125. Price: 2s. 9d.

"Rypins' Medical Licensure Examinations: Topical Summaries, Questions and Answers", edited by Walter L. Bierring, M.D., F.A.C.P., M.R.C.P. (Edin.); Fifth Edition; 1945. Philadelphia, London, Montreal: J. B. Lippincott Company; Sydney: Angus and Robertson Limited. 9" × 6", pp. 568. Price: 45s.

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MEDICAL PRACTITIONERS are requested not to apply for any appointment mentioned below without having first communicated with the Honorary Secretary of the Branch concerned, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

New South Wales Branch (Honorary Secretary, 135, Macquarie Street, Sydney): Australian Natives' Association; Ashfield and District United Friendly Societies' Dispensary; Balmain United Friendly Societies' Dispensary; Leichhardt and Petersham United Friendly Societies' Dispensary; Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney; North Sydney Friendly Societies' Dispensary Limited; People's Prudential Assurance Company Limited; Phœnix Mutual Provident Society.

Victorian Branch (Honorary Secretary, Medical Society Hall, East Melbourne): Associated Medical Services Limited; all Institutes or Medical Dispensaries; Australian Prudential Association, Proprietary, Limited; Federated Mutual Medical Benefit Society; Mutual National Provident Club; National Provident Association; Hospital or other appointments outside Victoria.

Queensland Branch (Honorary Secretary, B.M.A. House, 225, Wickham Terrace, Brisbane, B.17): Brisbane Associated Friendly Societies' Medical Institute; Bundaberg Medical Institute. Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY HOSPITAL or position outside Australia are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.

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Western Australian Branch (Honorary Secretary, 205, Saint George's Terrace, Perth): Wiluna Hospital; all Contract Practice appointments in Western Australia. All Public Health Department appointments.

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